MACHINERY

JANUARY 4, 1961 ONE SHILLING & THREEPENCE

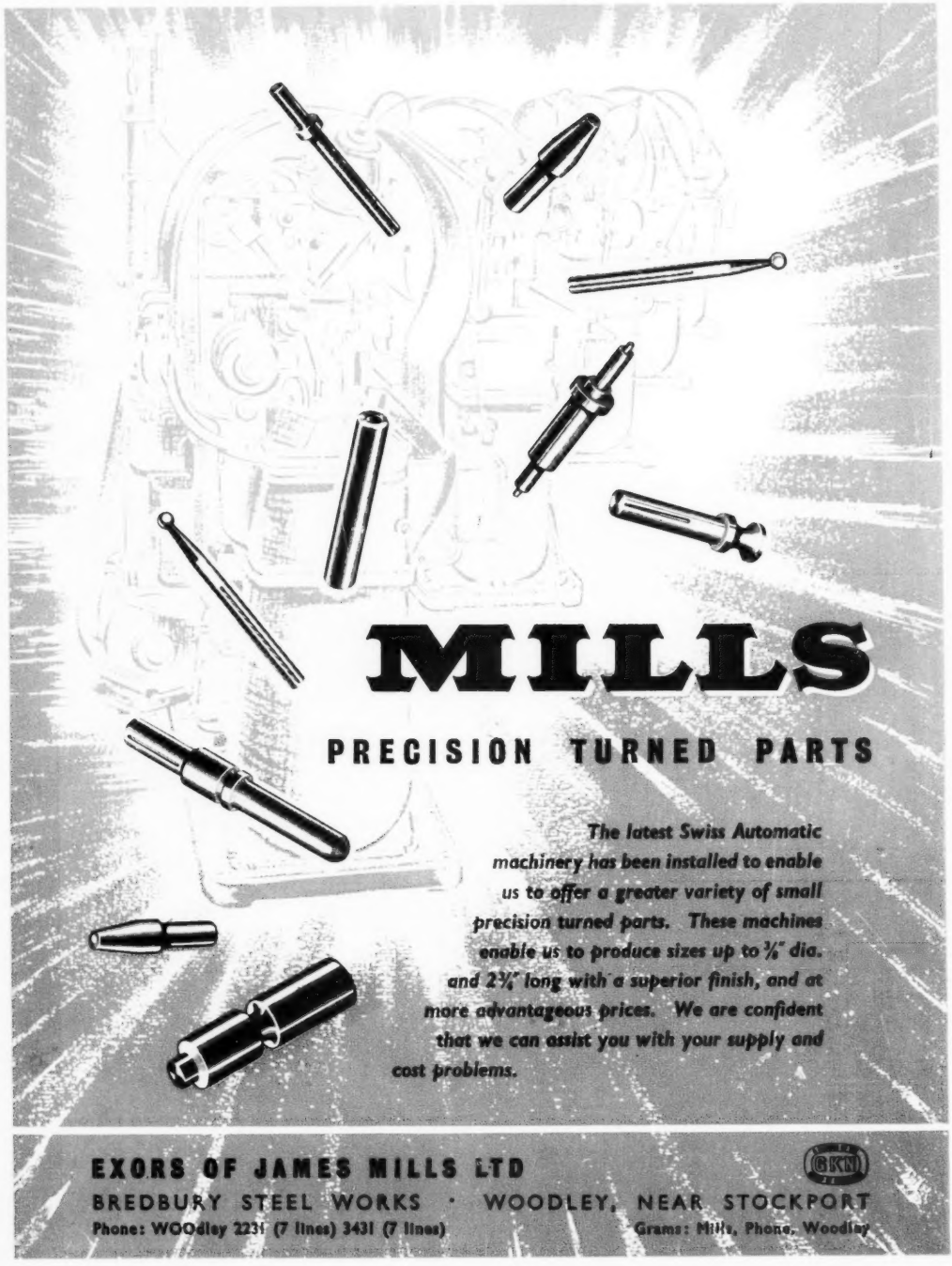
WALKER
high quality tools

BROCHURE ON REQUEST

GEORGE WALKER & SONS (BIRMINGHAM) LTD

MARCHING AHEAD FOR OVER A CENTURY....

GEO. WALKER & SONS (B'HAM) LTD. WARWICK RD., TYSELEY, BIRMINGHAM, 11


MILLS
PRECISION TURNED PARTS
The latest Swiss Automatic machinery has been installed to enable us to offer a greater variety of small precision turned parts. These machines enable us to produce sizes up to ⅜" dia. and 2¾" long with a superior finish, and at more advantageous prices. We are confident that we can assist you with your supply and cost problems.
EXORS OF JAMES MILLS LTD
GKN
BREDBURY STEEL WORKS · WOODLEY, NEAR STOCKPORT
Phone: WOOdley 2231 (7 lines) 3431 (7 lines)
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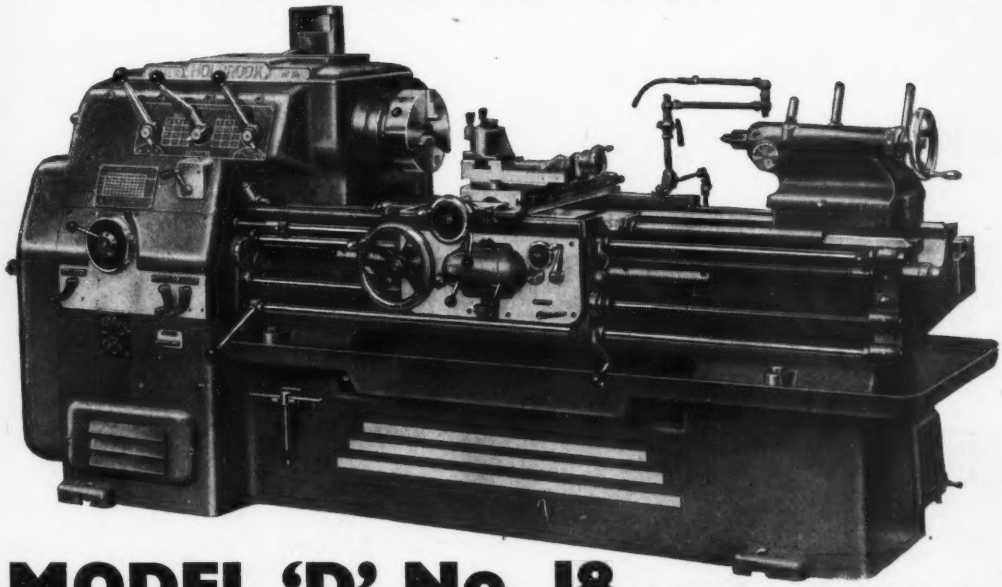
PRODUCTION WITH PRECISION

. . . . . 18 SPINDLE SPEEDS 15 TO 1000 R.P.M.



MODEL 'D' No. 18 NOMINAL CAPACITY 18" × 42"

PRECISION LATHES WITH . .

HARDENED BEDWAYS

CAM-LOCK SPINDLE NOSE
ENCLOSED GEARBOX AND APRON
BUILT-IN TAPERING EQUIPMENT
PRECISION LEADSCREW WITH COMPENSATING END THRUST

PRECISION GROUND COVERED BEDWAYS
60 THREADS & FEEDS : ELECTRIC SUDS PUMP
MECHANICAL PROFILING AND FULL RANGE ADDITIONAL EQUIPMENT AVAILABLE

Telephone : HARLOW 2351-2-3

HOLBROOK MACHINE TOOL CO. LTD.

CAMBRIDGE ROAD, HARLOW, ESSEX

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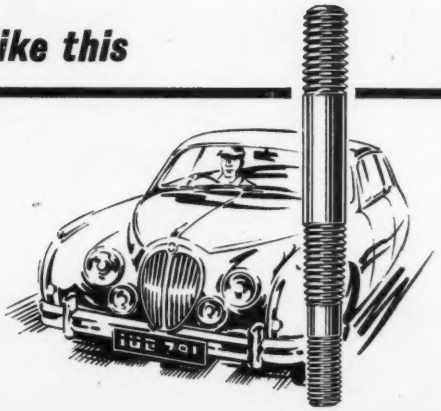
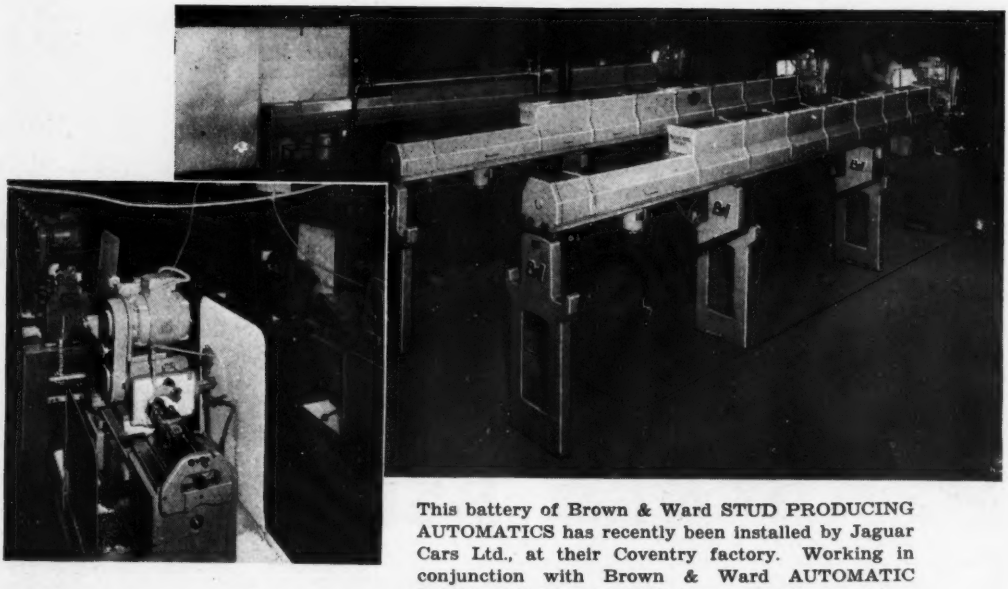
A

To PRODUCE COMPONENTS like this



JAGUAR cars choose BROWN & WARD



This battery of Brown & Ward STUD PRODUCING AUTOMATICS has recently been installed by Jaguar Cars Ltd., at their Coventry factory. Working in conjunction with Brown & Ward AUTOMATIC MAGAZINE BAR FEEDS these precision machines are producing components, like the threaded stud shown above, at maximum output and to the exacting standards required by Jaguars. The simplicity of these machines and equipment ensures reliability, and consequently a high productive efficiency, a fact which has been proved by the large numbers of machines installed in this and many other countries throughout the world.

Selling Agents in the U.K.: ALFRED HERBERT LTD., COVENTRY

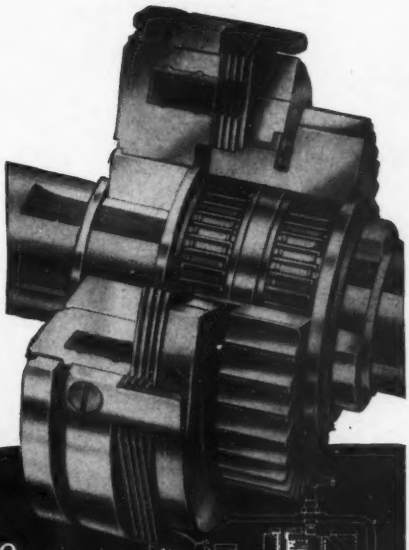
Automatic Bar Machines and Magazine Bar Feeders

BROWN & WARD (TOOLS) LTD.

Leamore Lane, Walsall. Telephone Bloxwich 76846

W & W

for stop . . . go . . . fast . . . s-l-o-w machining



Electromagnetic Multiple Disc CLUTCHES

cut non-productive time to a minimum

Electromagnetic Multiple Disc Clutches have proved their efficiency and reliability on a wide variety of machines. Time loss is minimised during changeover stops. Work spindle speed can be varied over a wide range at constant power. Ratios of feed-drive speed to rapid-motion speed in excess of 1:50 are easily obtained.

These Clutches facilitate special production such as automatic machining of a wide variety of work-pieces.

These advantages mean much to the user!

- **Unit unaffected by oil.**
- **No adjustment required at any time.**
- **Small dimensions at high torques.**
- **Low energy consumption through efficient flux utilization.**
- **For torque transmission over very wide range.**

Our Electromagnetic Multiple Disc Clutches are available in various designs.

FARADAY WORKS · GT. WEST RD. · BRENTFORD · MIDDX.
Telephone: ISLeworth 2311
Grams: Siemensdyn Brentford Hounslow Telex No. 25337

Siemens-Schuckert (Great Britain) Ltd

Smee's S100

* MOULDS KEEP ON GETTING BIGGER

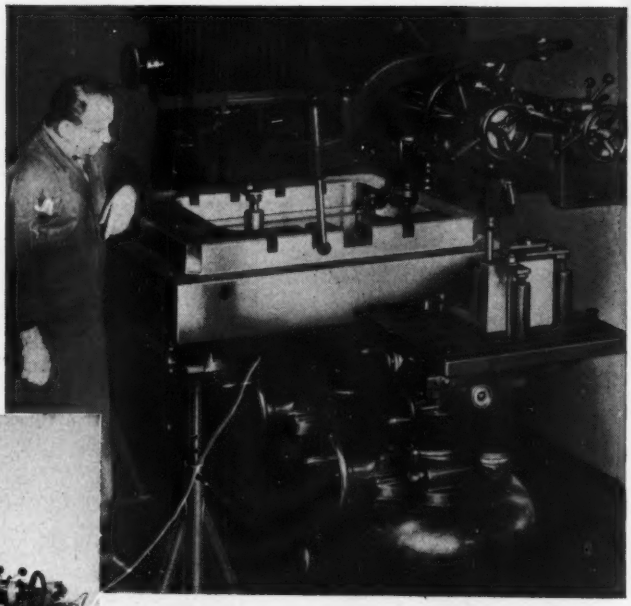
KAMPF

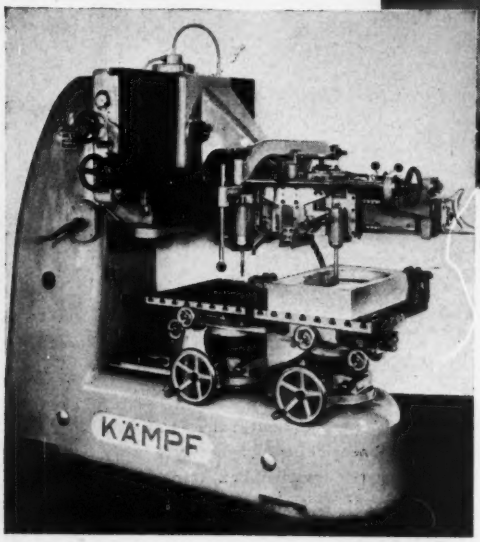
MODEL FK3

THREE-DIMENSIONAL

DIE SINKING MACHINE

. . . ensures true three-dimensional scanning. Working area 28" x 36". Maximum die block height 20". Maximum dead weight on table 1½ tons. Outside supports, however, enable much heavier and bulky jobs to be easily tackled.





* Profile milling radii into a die, size 43" x 33½" x 14", weight 2½ tons. Material 70 ton tensile steel.

EARLY DELIVERY

EMBASSY MACHINE & TOOL CO. LTD.
TELEPHONE : SUNNYHILL 2829

248 WATFORD WAY, LONDON, N.W.4
TELEGRAMS : EMBATOL, LONDON

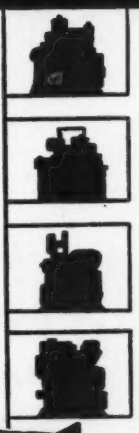
EMBASSY
FOR OUTSTANDING MACHINE TOOLS

Your Auto is NOT Fully Automatic without

LIPE BAR FEED

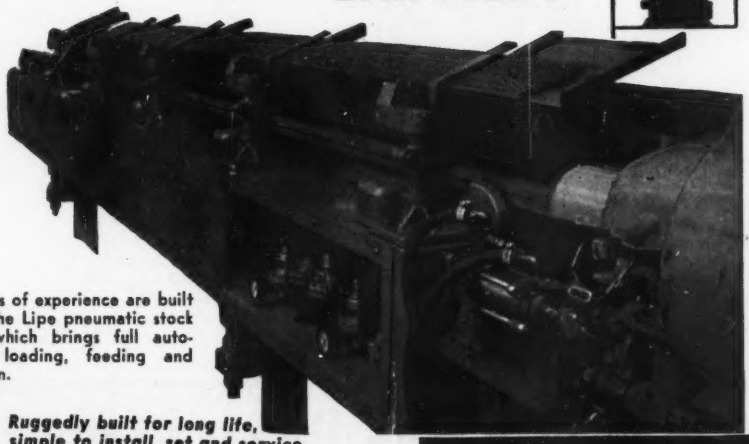
Here's Why...

- **A** Reloading time cut to 4 seconds.
- **B** Machine runs continuously—no time wasted.
- **C** Absolutely reliable — one operator can handle several machines.
- **D** 30% to 100% production increase.
- **E** No feed fingers—feeds to LAST workpiece and ejects remnant automatically.
- **F** Patented Rear Ejection gives positive control of remnant at all times, increases versatility of Bar Feed.



THERE'S A **LIPE** FOR MOST BAR FED MACHINES

LIPE FULLY AUTOMATIC PNEUMATIC **BAR FEEDS**



Years of experience are built in to the Lipe pneumatic stock feed which brings full automatic loading, feeding and ejection.

Ruggedly built for long life, simple to install, set and service.

Models cover range from $\frac{1}{16}$in. to 1$\frac{1}{4}$in. bar and $\frac{1}{8}$in. to 1$\frac{1}{2}$in. tube.

Send for Data to Dept. M.2332

Patents Nos. 728898 and 743461, 827417

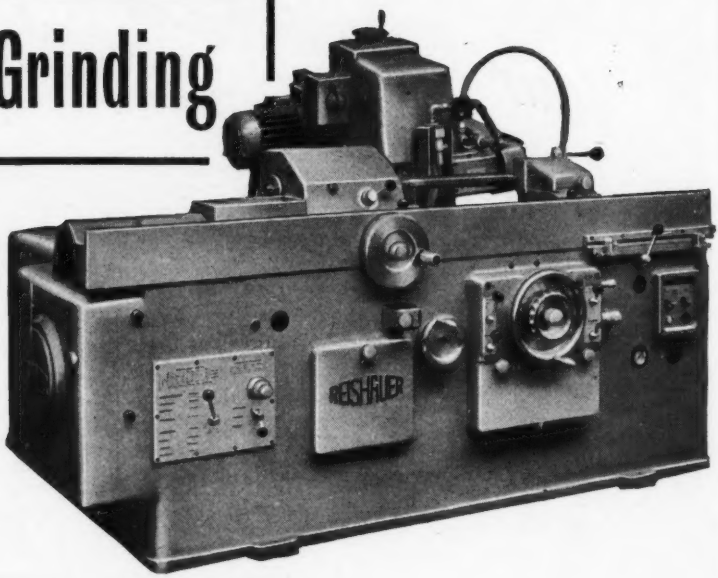
Automation Ltd.

DEVONSHIRE HOUSE VICARAGE CRESCENT LONDON S W 11

PHONE: BATTERSEA 5548

NRP 233

For Absolute PRECISION in Thread Grinding



SWISS **REISHAUER**

UNIVERSAL THREAD GRINDER MODEL US

Thread gauges, precision threaded components, relief ground cutting tools and worm threads can be ground with exceptional accuracy of pitch, diameter and form. Almost any thread can be ground — external or internal, left or right hand, single or multi-start — *and* taper threads without setting over the table or tail-centre.
The machine is equally economical on batch work or single components. Minute pitch corrections as small as .00008″ per inch can be made. Single or multi-ribbed grinding wheels can be employed — and two way grinding. The grinding head can be swivelled up to 40° left or right.

Grinding length 17¾″. Length between centres 42½″.
Work diameter 5/64″ to 9¾″. Bore through work spindle 1.77″.
Pitches 80 t.p.i. to 4″, Grinding wheel speeds 1700 to 2540 r.p.m.

Send for fully illustrated brochure M/183

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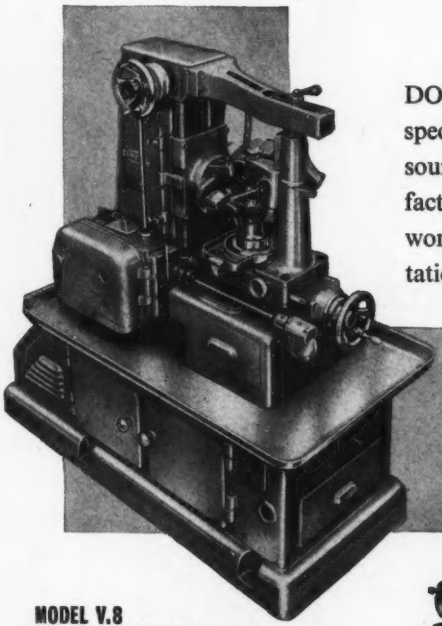
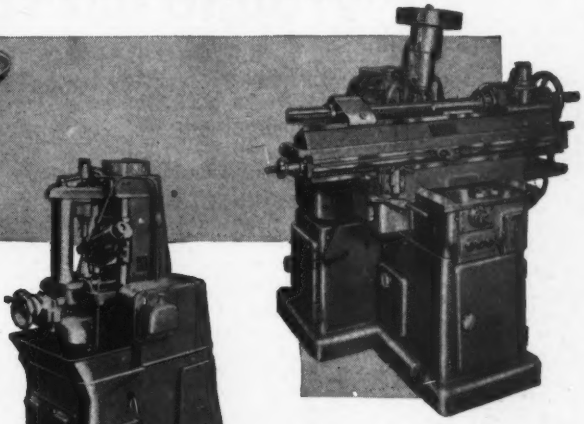
HOBBING

–it pays to investigate

BRITISH-BUILT DOWDING



DOWDING Hobbers have been developed by gear specialists: their accuracy and economy are the result of sound basic design coupled with craftsmanship in manufacture. They are to be found in leading engineering workshops throughout the world, earning a high reputation for their accuracy and dependability.



MODEL V.8
UNIVERSAL HOBBING MACHINE
Accurate, versatile, economical. With built-in differential. For spurs, helicals, wormwheels, and worms. Tangential feed and cam operated plunge feed are optional extras. Maximum dia. 8", 7" Face. 12 D.P.

MODEL V.4
UNIVERSAL HOBBING MACHINE
Accurate, rigid, and versatile. With built-in differential. For the smaller spurs, helicals, worm wheels, and worms used in light engineering and instrument work. Tangential feed is also available.
Up to 4" Diameter, 4" face, 20 D.P.

MODEL H.7
HORIZONTAL HOBBING MACHINE
Powerful and rigid. With built-in differential. For long splines and gears integral with long shafts, and parallel and taper serrations. Alternative heavy duty or high helix angle hob heads. Maximum dia. 7". Hobbing length 18". 8 D.P.

Ask us to send our new illustrated Hobbing brochure M/128

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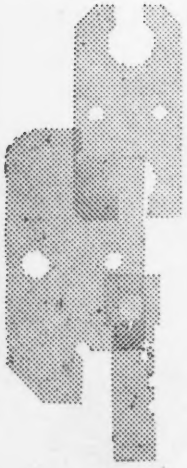
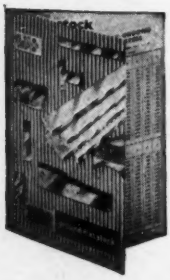
FOR A MULTITUDE OF PURPOSES



ground flat stock

This isn't just ordinary ground flat stock. To start with, it's "Wardson" carbon chrome alloy steel, oil hardening, non-distorting. Then it's precision-ground to .001 limits on 1/32" to 2" thicknesses, and cut to 18" and other lengths. Widths are from ¼" to 12" which provide the perfect basis for gauges, templates, jigs, tools, machine parts, etc. Special sizes to order.

ROTARY CUTTERS · MACHINE KNIVES
METAL SLITTING SAWS · TOOL BITS
REAMERS · GROUND FLAT STOCK
MILLING CUTTERS · SCREW SLOTTING SAWS



Wardson

a famous Sheffield name for cutting tools

Wm. WARD & SON (SHEFFIELD) LTD. Established 1835
Centenary Works, Woodseats Road, Sheffield 8, England
Telephone: 52451 (2-lines). *Telegrams:* "Wardson, Sheffield 8"
Registered Trade Marks: "Wardson" · "Rubicon"

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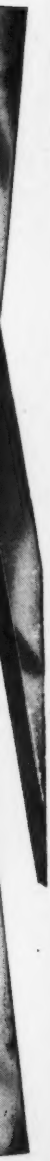
1961



Now available for EARLY DELIVERY

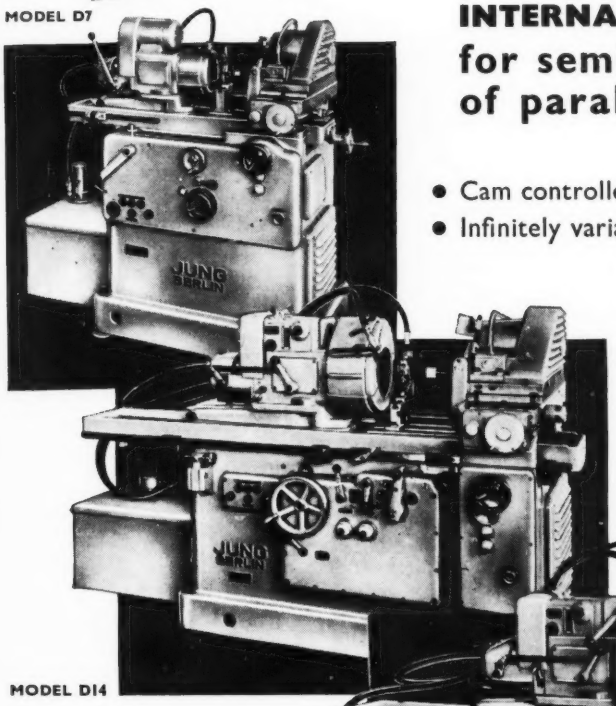
NEW 'D' TYPE

JUNG

INTERNAL GRINDING MACHINES

for semi-automatic grinding of parallel and taper bores

MODEL D7



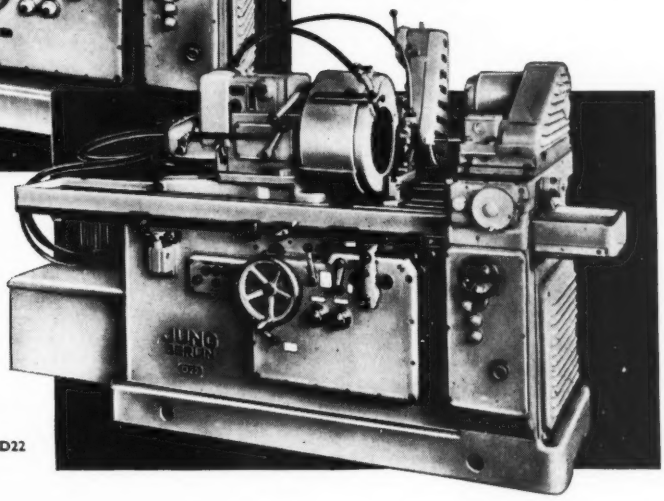
Features include:-

- Cam controlled hydraulic wheel infeed
- Infinitely variable table speed control
- Sizing to preset diamond
- Work head swivel 30°
- Centralised Controls for quick setting up

Radius and profile dressers and face grinding attachments available for all models.

Fully Automatic Models also available.

MODEL D14



MODEL D22

CAPACITIES

Model	Max. Bore Diameter	Max. Bore Length
D7	1⅝"	2¾"
D14	4"	6"
D22	6"	10"

Sole Agents:

ROCKWELL MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

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NEW DESIGN!

LARGER CAPACITY!

Latest

THIEL

FILING & SAWING MACHINE

for the manufacture of Dies, Gauges etc. to very close limits

MODEL 115

SPECIAL ATTACHMENT PERMITS FILING & SAWING OF HARDENED STEEL & TUNGSTEN-CARBIDE

SPECIAL THIEL *FEATURES include—*

Infinitely Variable Speed

Infinitely Variable Stroke Adjustment

Stroke adjustment does not necessitate altering table height

Table tilts 15° in both directions

Tungsten-Carbide and Hardened Steel filing and sawing (Special attachment)

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Thiel 115

MATRIX
COVENTRY GAUGE & TOOL COMPANY LTD
QUALITY

BRITISH BUILT
"American" HORIZONTAL
BROACHING MACHINES

Can be supplied with Matrix Designed and Manufactured Tooling to your requirements.

For broaching round, square, hexagonal and other holes, keyways, splines. Also suitable for surface broaching. Easy, quick job change. 48" stroke, normal capacity 10 tons. Broaching speed infinitely variable 5-15 F.P.M. with quick return. Simple stroke and speed adjustment. Single lever control of ram. Hardened and ground ram ways automatically lubricated.

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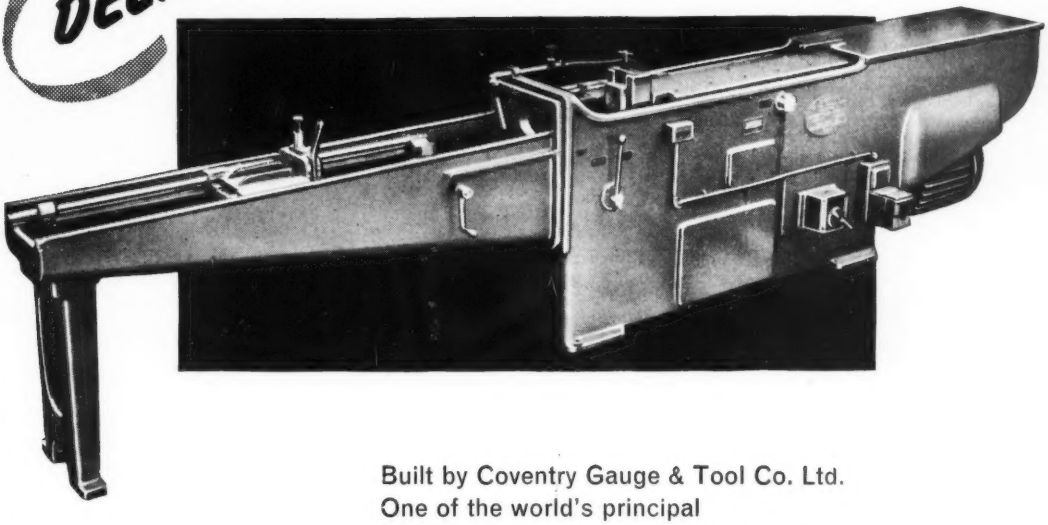

Built by Coventry Gauge & Tool Co. Ltd.
One of the world's principal
Manufacturers of Broaching Machines
and Broaching Tools

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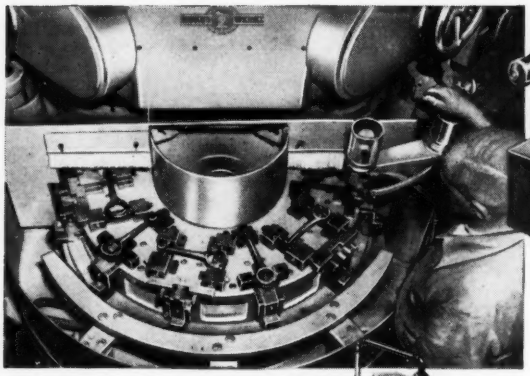
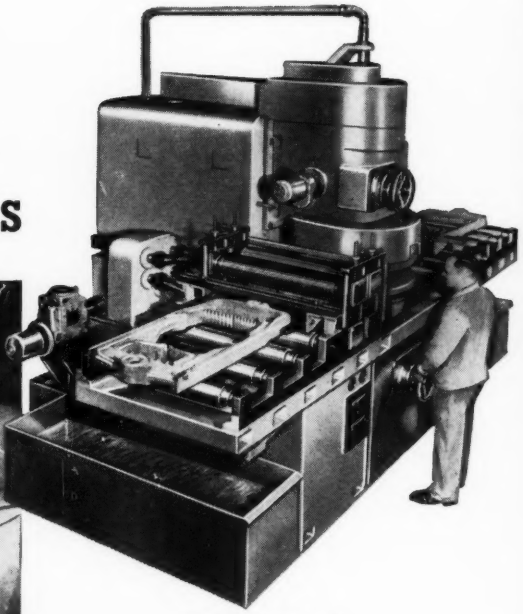
ABH4

DISKUS

SPECIAL PURPOSE GRINDING MACHINES



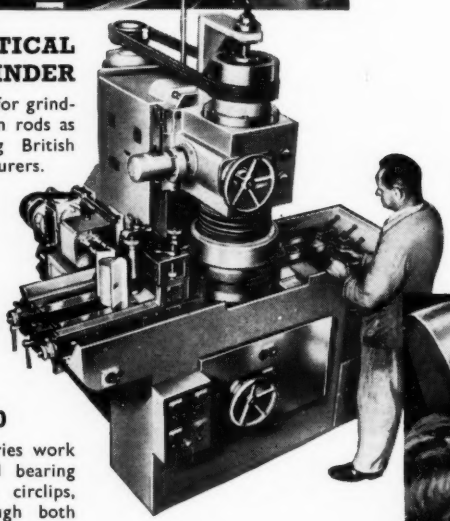


TYPE DDS 900

For simultaneous grinding of parallel faces on bulky components such as machine frames, etc.

DOUBLE VERTICAL SPINDLE GRINDER

With sizing control for grinding both sides of con rods as supplied to leading British automobile manufacturers.



TYPE DD

For precision grinding of parallel faces of small components by continuous through grinding with straight line or circular feed.

Also adaptable to automatic loading.

TYPE DDS 600

Transport band carries work pieces such as ball bearing rings, piston rings, circlips, etc., straight through both wheels.

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feed.

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CONTROLLED PITCH TAPPING MACHINES by VIGEL TORINO

Model Delta. Capacity in Steel $\frac{7}{8}$". Capacity in other metals $1\frac{1}{4}$".

Model Alfa TR. Capacity in Steel $\frac{5}{16}$". Capacity in other metals $\frac{13}{32}$".

Beta Model. Capacity in Steel $\frac{5}{16}$". Capacity in other metals $\frac{13}{32}$".

The Vigel range covers a wide field of tapping needs. Single and multi-spindle machines can be supplied.

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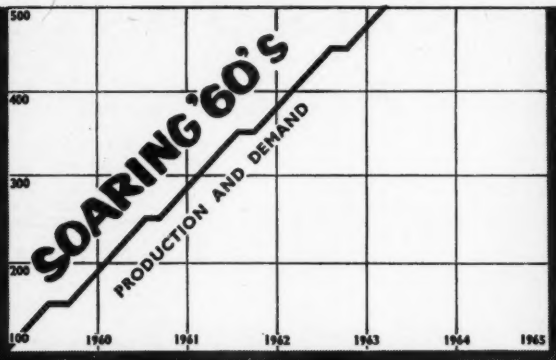

Specify HSM BRAND TUNGSTEN CARBIDE

Tungsten Carbide, Tips, "Thro'away" Tips and Tool Bits: Lathe Tools:
Milling Cutters: Special Cutters: Special Reamers: Special Drills.
Wire, Bar and Tube Drawing Pellets and Finished Dies: Valve Heading Dies:
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Cupping Dies: Indent Dies: Press Tools and Inserts.
Percussion Drill Inserts: Rock Drilling Bits:
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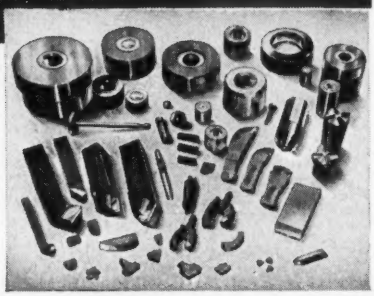
File Cutting Chisels. Guides and Eyelets for Textile Machinery.
Depth Control Marks and Dies for hot and cold marking operation.
Small parts subject to compression and heavy wear, i.e. Shot Blast Nozzles, Brick Moulds, etc.



SAVE UNNECESSARY GRINDING !
Delivery of Tips:—Special Shapes, 7 days: Urgent Requirements, 24 hours: Standard Tips, 3-4 days

Each year more and more applications are found for HSM Cemented Carbides:—effecting longer life, higher cutting speeds and lower costs. If you have a cutting, pressing or excessive wear problem that may be solved by the possible use of HSM Tungsten Carbide, our advice, based on over 25 years' intimate study of Powder Metallurgy and metals for Higher Speed production, is at your disposal.

HARD METAL DIVISION Designed in laboratory style specifically to produce Cemented Carbides from powder form to sintered product.

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Manufacturers of Hard Metals since 1938 Incorporated 1915

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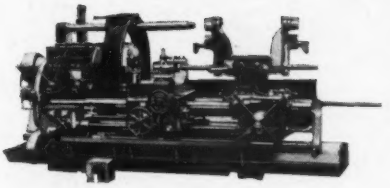
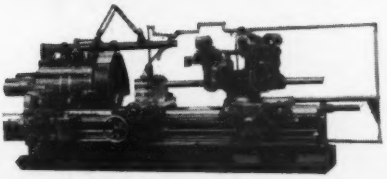
FOR HEAVY TURRET LATHE WORK

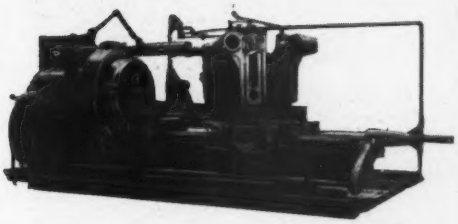




The Herbert range of powerful and rigid lathes for heavy cuts at coarse feeds on all work up to 36" swing; unsupported light work up to 45" swing.

Have advantages common to Herbert Capstan Lathes—the power, speeds and feeds to use carbide tools, ease of setting-up for economical machining of small batches, fast cutting times, high and consistent accuracy and excellent finish.

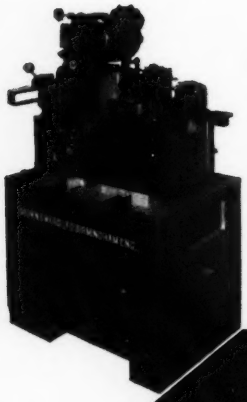
On this Herbert No. 14/36 Combination Turret Lathe at the Caterpillar Tractor Co. Ltd., Newcastle, a 50 h.p. motor and Ardoloy tools permit heavy metal removal when machining a 34in. diameter rim collar from a steel forging.



7 sizes: manufacturing, cross-sliding turret and combination turret types.

ALFRED HERBERT LTD., COVENTRY

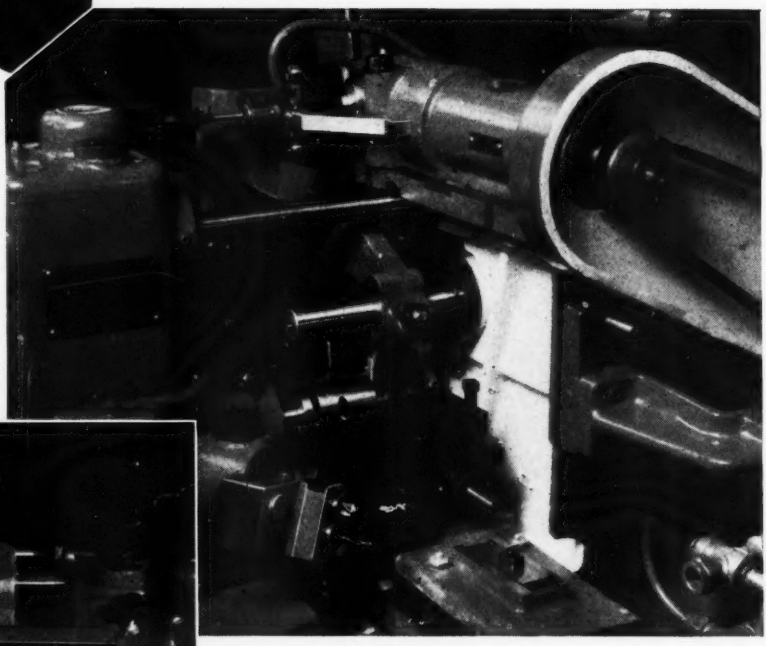
AD518



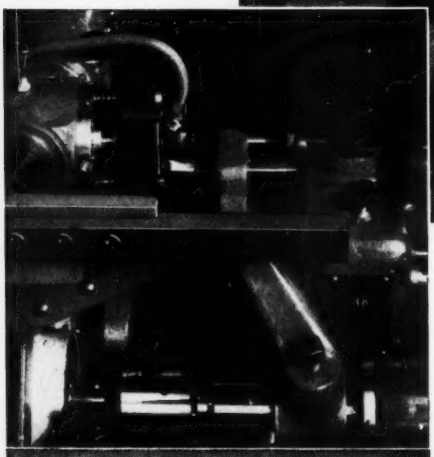
designed for economical high production of small components

BROWN & WARD

AUTOMATIC BAR MACHINES



A Brown & Ward ¾" 4-operation machine producing a brass nozzle in 5·7 secs. The machine is fitted with a rear end drilling attachment, as shown in the close-up. A transfer arm moves the nozzle as it is parted-off from the bar, to the attachment for drilling and chamfering the small hole simultaneously with the machining of the next piece.



An extremely wide range of work can be economically produced on Brown & Ward Single-Spindle Automatics. By virtue of their simplicity in setting-up, operation and maintenance and by their low cost compared with more complex machines, they ensure high-production repetition work at lowest possible cost per piece.

Range of machines for bar work up to 1¼" dia. x 4½".

Automatic stud machines also available.

ALFRED HERBERT LTD., COVENTRY

AD 560

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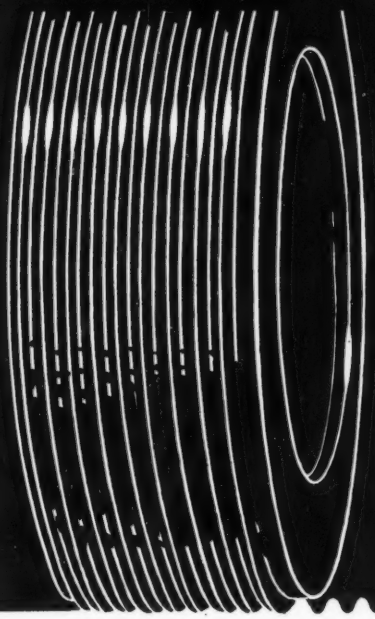

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Herbert Ground-Thread Rolls for thread rolling die-heads have achieved a high reputation for precision and durability combined with high rates of production.

with HERBERT ground-thread rolls

These rolls are made in the same works and under the same conditions as Coventry Die-heads and Dies and Herbert-Ground Thread Taps which are world-renowned for quality and accuracy.

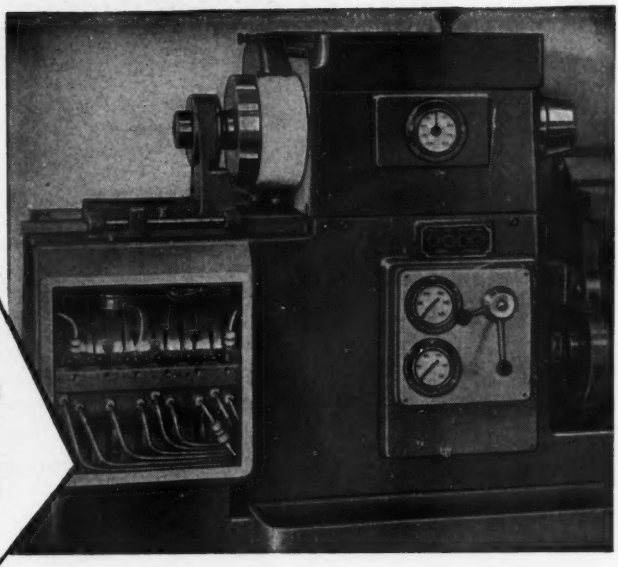
Large stocks of rolls, covering all the most generally-used standard thread forms and sizes up to $1\frac{1}{4}$" diameter, are maintained.

Full details and prices are obtainable from our Threading Dept., Head Works.

We also manufacture circular and flat thread-rolling Dies to suit all leading makes of machines.

ALFRED HERBERT LTD., COVENTRY

AD522



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for GREATER FLEXIBILITY — GREATER PRODUCTION CAPACITY

BUTTERWORTH

HYDRAULIC AUTOMATIC

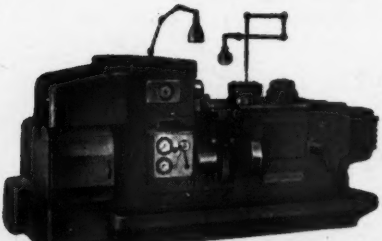
cuts costs on short or long runs

● ADVANCED DESIGN ● NEW STANDARDS OF PRODUCTIVITY ● INFINITELY VARIABLE FEED CONTROL ● NO SPECIAL CAMS

Here is a machine to meet to-day's demand for lower costs. Ample power, combined with foolproof hydraulic control of feed, elimination of special cams, and great flexibility ensure the highest possible production rates, even on small batches. Note, too, the chucking and bar feed are hydraulically operated.

The range of sizes covers work from 1⅝", 2",2½", 3" & 3½" diameter bar. Hydraulic copy turning attachment and cross slide longitudinal turning attachment available.

Other sizes and models include ⅞" SD, ⅞"-1 1/16" SD, 1¼" AG, 3" AG & 3½" AG.



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You may think we said that before we know your job, but we do it with the confidence that these machines are very versatile and will tackle all the usual sheet metal folding and bending and some quite unusual ones, too, with astonishing ease.

Full adjustment to the beams and folding centres give accurate results in all bends from sharp to 1in. true radius. Replaceable bearings, counter-weighted folding beam with precisely positioned levers, reduce labour effort; extra refinements of speedy lever clamping and pre-set angle of bend stop, step up operation rate. Virtually unbreakable welded steel plate construction.

Made in 12 sizes from 36in. to 120in. x 16, 14 and 12 S.W.G. mild steel. Popular sizes are 48in., 72in., 96in., x 14 S.W.G.

Fuller details and delivery times will be sent at your request. Generally, delivery is ex stock.

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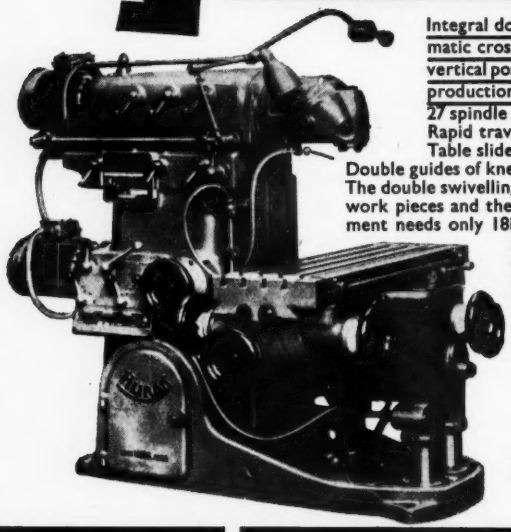
SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



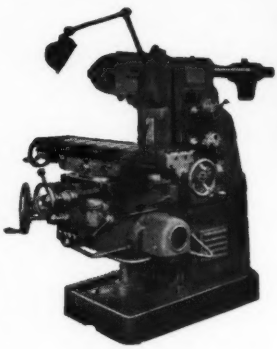
Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56$\frac{5}{16}$in. × 15¾in.	43¼in.	27½in.	19⅝in.
KU5	64$\frac{5}{16}$in. × 15¾in.	51⅛in.	27½in.	19⅝in.
KU6	78¾in. × 16½in.	59in.	27½in.	19⅝in.
KU55	64$\frac{5}{16}$in. × 26in.	51⅛in.	39⅜in.	18$\frac{5}{16}$in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

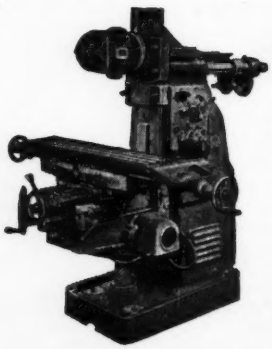
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5⅛in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r p.m.; 8 automatic feeds ½-18¾in

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ⅜-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{5}{16}$-23⅝in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43¼in. × 9⅞in.	27½in.	9⅞in.	15¾in.
61	47¼in. × 10⅞in.	30¾in.	9⅞in.	15¾in.
59	51$\frac{5}{16}$in. × 11⅞in.	34⅝in.	11$\frac{13}{16}$in.	21$\frac{1}{16}$in.
54	67in. × 14¾in.	43⅜in.	14⅛in.	20¼in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

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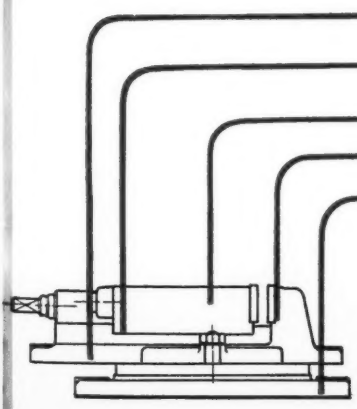
THE VICE

with all the virtues



V SLIDES ADJUSTABLE FOR WEAR. LONG BEARING SURFACES. IMPOSSIBLE FOR THE JAW TO LIFT AND TILT THE JOB.

TOTALLY ENCLOSED HARDENED SQUARE THREAD SCREW WHICH CANNOT BECOME SEIZED OR BRUISED.

SLIDING JAW MACHINED OVER ITS WHOLE SURFACE FOR THE USE OF THE SCRIBING BLOCK.

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ACCURATELY MACHINE DIVIDED SWIVEL BASES INDEXED FULLY THROUGH 360°.

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ABWOOD MACHINE TOOLS LIMITED

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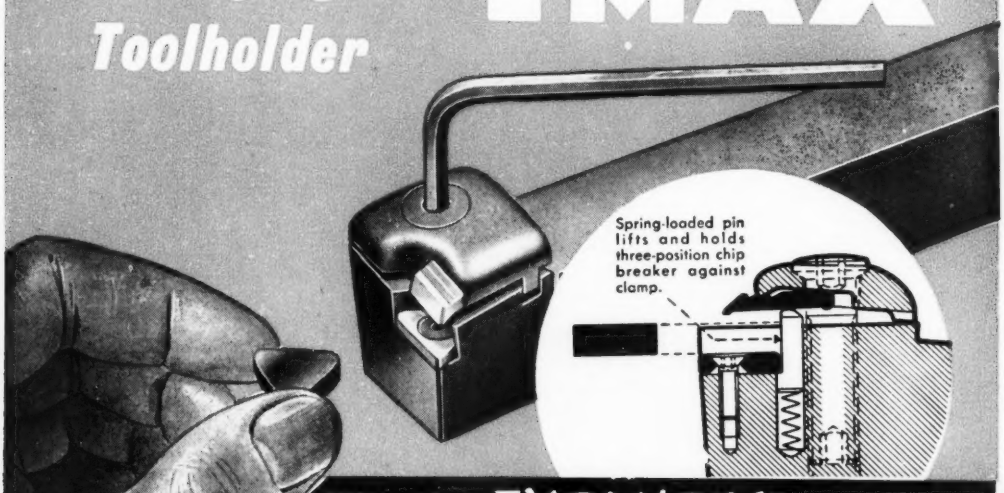
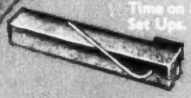
T-MAX



With the EXCLUSIVE Spring Lifted Three Step Chipbreaker

Same Wrench Operates Screw from Top or Bottom. Saves Time on Multi-tool Set Ups.



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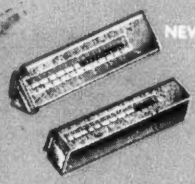
Puts a new insert at your fingertips. Calibrated slot shows remaining inserts.



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Covering various T-Max styles and other technical data.

Loosen, change, tighten—and you're back in production. It's as quick and easy as that with Coromant T-Max—fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or both the carbide cutting edge and depth of cut without removing or replacing chip breaker.

When set screw is loosened, a spring-loaded pin automatically lifts and holds chipbreaker against clamp—lets you change or index insert with no waste motion. When changing cut, a push with the wrench clicks the solid carbide chipbreaker into desired position for light, medium or heavy cut.

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- Shank of heat treated alloy steel holder - Rockwell Hardness C50, guards against damage. Special SR treated, anti-rust finish.
- Precision cast, alloy steel clamp is streamlined for free chip flow.
- Low cost chipbreaker cuts replacement expense.

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Optical adjustment
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Projection optics
Open-front design

Centralized lubrication
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Optical Jig Borers

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Table size 32" x 16"
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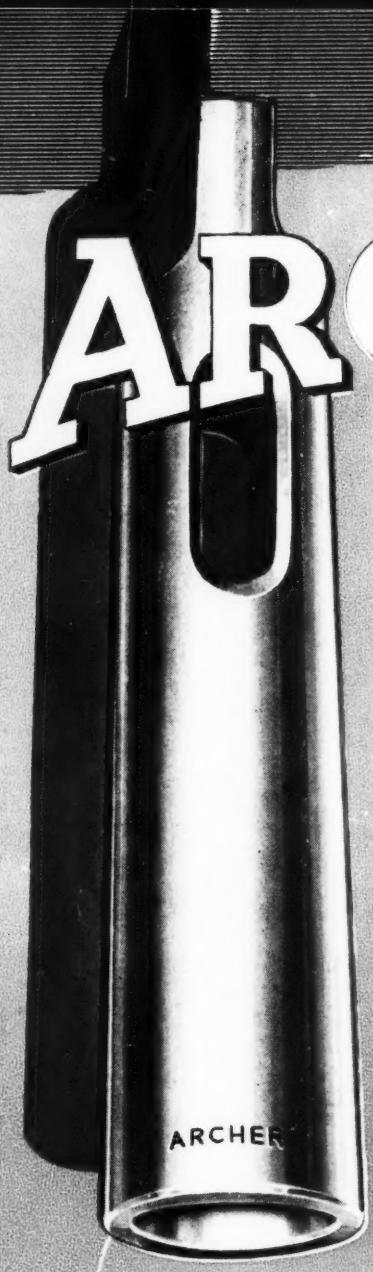

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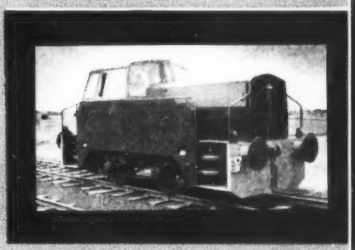
Harper-Meehanite Bell Housing
Weight: 203 lb.



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for the Rolls-Royce engines and torque converters used in Sentinel Diesel-Hydraulic Locomotives

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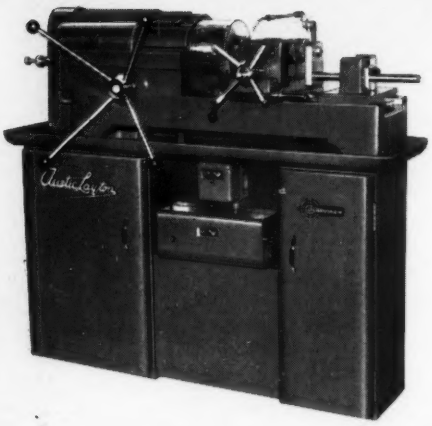
H677/2

NEW TIME-SAVING FROM THIS MACHINE

50%-60% ON ALL 'END' WORK



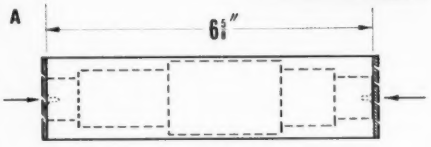
'CENTAMAX'—an all-British machine and the first machine to be specially designed to perform all types of work *on the ends* of bar, tube or forgings up to 3¼ in. diameter. Its multi-tool head enables a wide range of machining jobs to be done in ONE combined operation to show these substantial savings :

By normal methods 'A' will take about 2 minutes
BY 'CENTAMAX'—
50 seconds in ONE operation.

By normal methods 'B' will take 50 seconds
BY 'CENTAMAX'—
20 seconds in ONE operation.

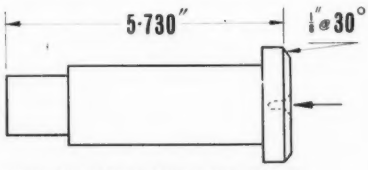
By normal methods 'C' will take 2 minutes
BY 'CENTAMAX'—
45 seconds in ONE operation.

A



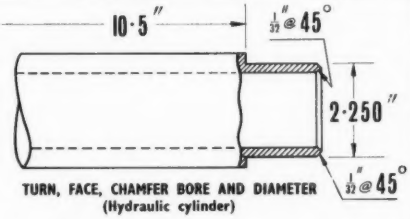
CENTRE AND FACE (Copy lathe job)

B



CENTRE AND FACE TO LENGTH AND CHAMFER
(Stud produced on capstan)

C



TURN, FACE, CHAMFER BORE AND DIAMETER
(Hydraulic cylinder)

★ **Small or medium batches are equally economical by *'CENTAMAX'*—it is single ended and can be set up in minutes.**

★ **Sensibly priced—under £650 basic.**

★ **Send for full particulars and include sketches of your 'end' work, when we shall be pleased to quote production times by *'CENTAMAX'*.**

CENTAMAX

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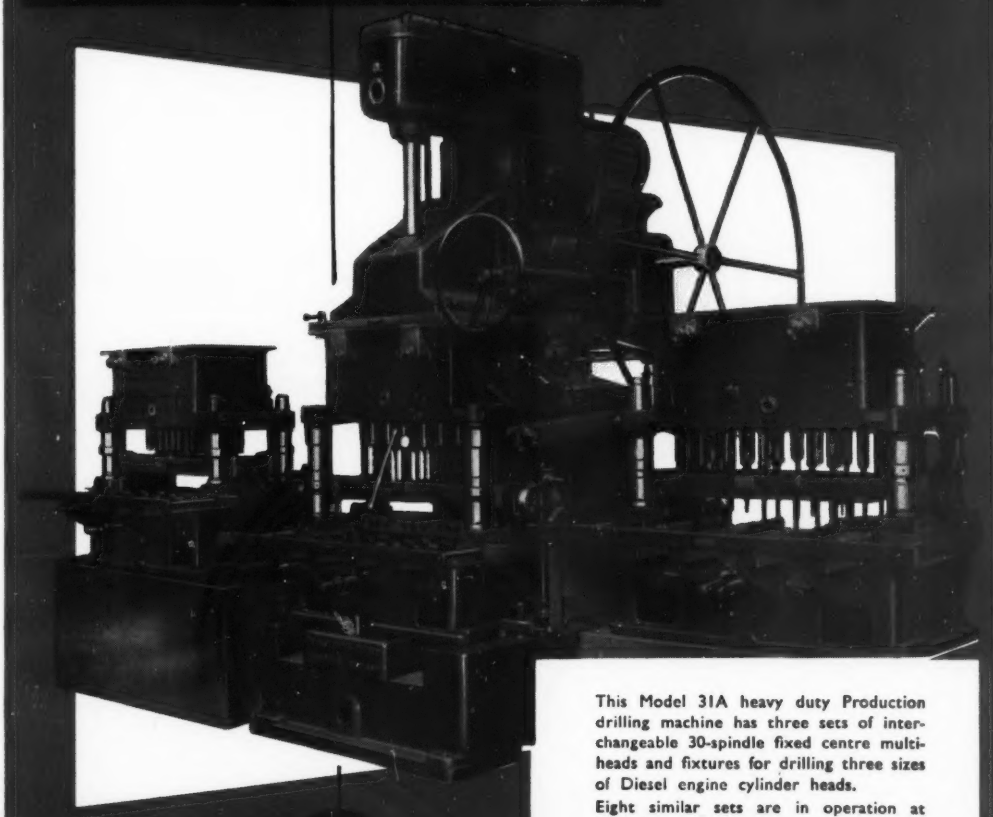
CORONA

high speed—
heavy duty

PRODUCTION DRILLING

on diesel engine cylinder heads at—F. Perkins Ltd., Peterborough



This Model 31A heavy duty Production drilling machine has three sets of interchangeable 30-spindle fixed centre multi-heads and fixtures for drilling three sizes of Diesel engine cylinder heads.

Eight similar sets are in operation at F. Perkins Ltd., Peterborough. Outstanding amongst the many features of this equipment is great stability, and accuracy of re-location with quick changeovers.

Complete changeover in nine minutes.

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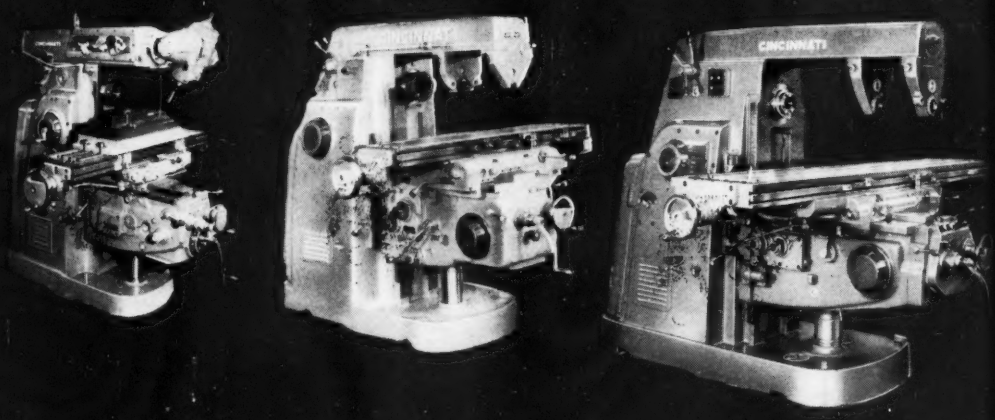


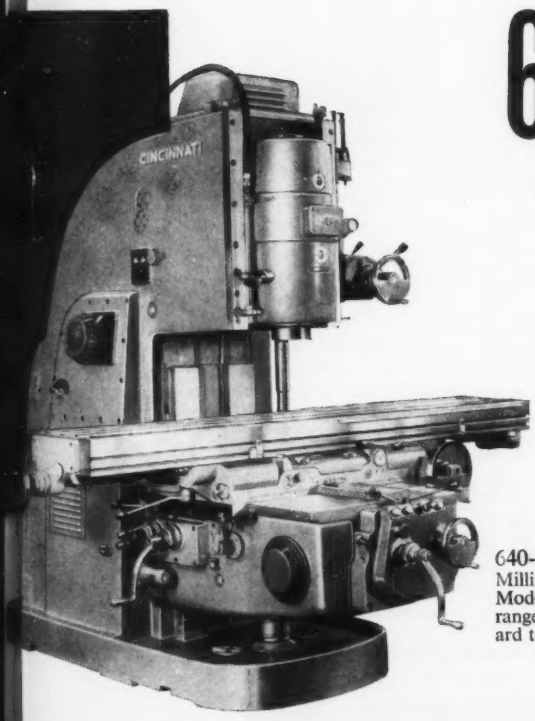
Universal Milling Machine Model 'L L' arranged with 3 HP Independent Overhead Spindle.

Milling Machine Model 'E L R' arranged with fully automatic table cycles.

Milling Machine Model 'L L' arranged with fully automatic table cycles.

CINCINNATI

CINCINNATI MILLIN



640-20 Dial Type Milling Machine Model 'E L A' arranged with standard table cycles.

64 DIFFERENT STYLES AND SIZE

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Machine Tool experts from home and abroad acclaimed
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service on every sort of operational requireme
maintaining their high degree of accur
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Cincinnati's progressive approach
machine tool design ensures that this outstand
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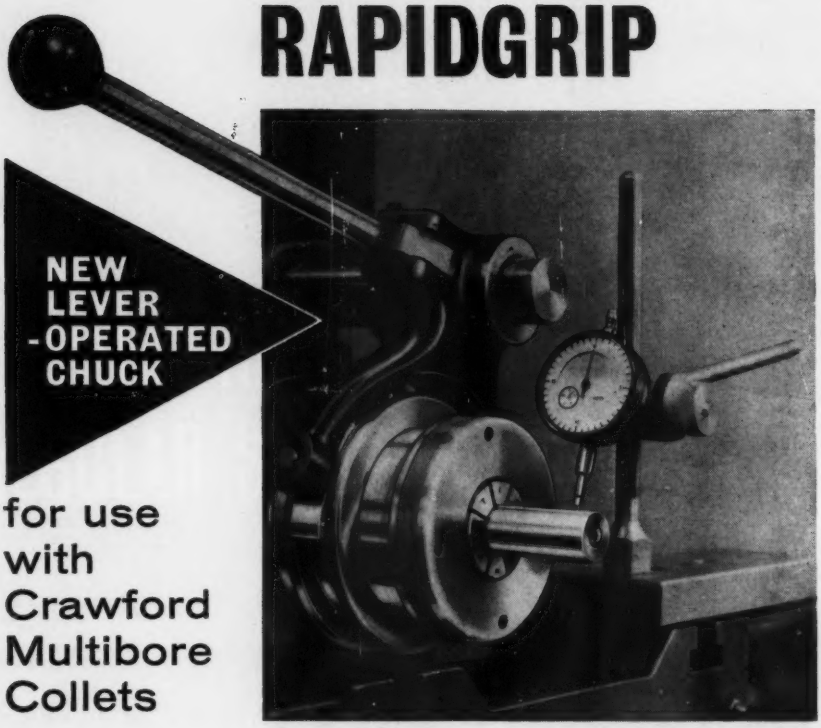
MACHINES LIMITED BIRMINGHAM 24

CRAWFORD RAPIDGRIP



NEW LEVER-OPERATED CHUCK

for use with Crawford Multibore Collets

This powerful new dead-length chuck is particularly suitable for bar and second operation work; fitted with a Crawford rear support stop it can hold exceptionally short pieces. It is designed for operating the Crawford Multibore Collets with their ¼" size range. There's less operator fatigue, too, because Rapidgrip's simple, powerful rack and pinion gear is easier to operate than more direct lever systems of collet closing. Another special feature is the fixed front cap which ensures constant accuracy. An independent key allows easy bore adjustment.

CRAWFORD COLLETS LIMITED

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You can't afford lost power . . . costly shutdowns due to transmission failures . . . That's why Goodyear is so often first choice where V-Belt efficiency and reliability is vital. It's best for the job because it's built for the job. From huge multi-vee installations to small F.H.P. applications there's a 'job-designed' belt in the Goodyear family tree to suit every drive and duty. The Goodyear Technical Service is freely available to advise on choice and optimum working conditions for longest, trouble-free performance.

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The Goodyear Tyre & Rubber Company (G.B.) Ltd., Industrial Rubber Products Dept., Wolverhampton

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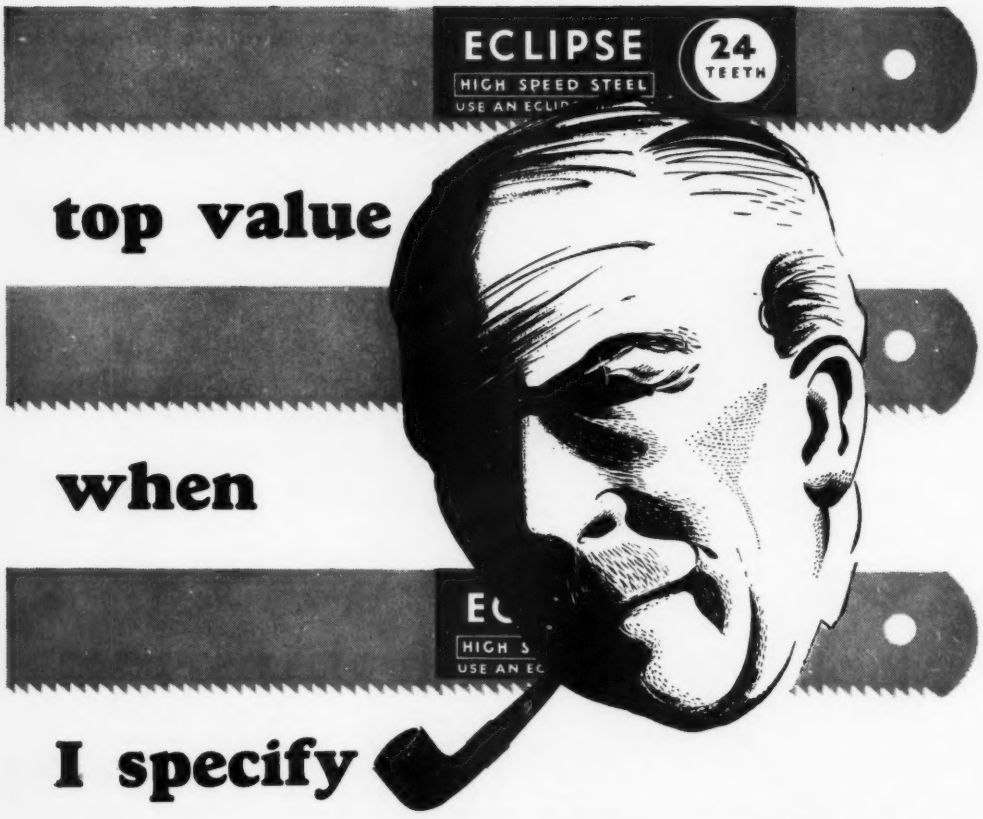

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Eclipse

HACK SAW BLADES

'Eclipse' hacksaw blades and other tools are made by James Neill & Co. (Sheffield) Ltd. and are obtainable from all tool distributors.

UH36

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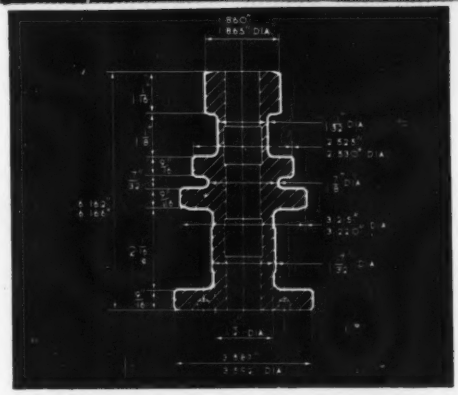

MACHINED IN 45 SECONDS

This 12-spindle No. 10 Ryder Verticalauto produces two machined transmission countershaft gears at each index.

Stellite and H.S.S. Tools cutting at moderate speeds and feeds have eliminated swarf problems and hydraulic operation of the mandrels and automatic hydraulic operation of the Loose Headstocks make loading easy to achieve within the cycle time.

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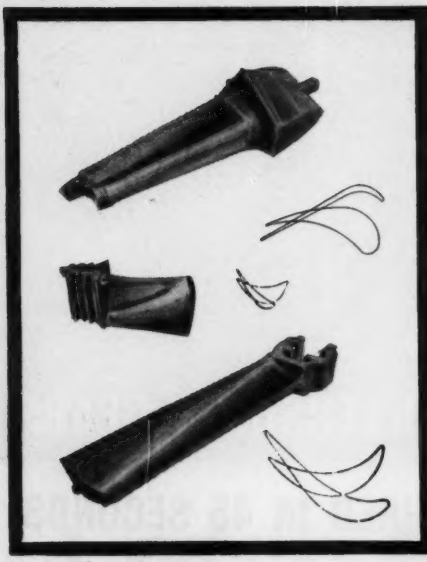

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- Accurate to ± ·002 in.
- Currently operating throughout the British turbine industry

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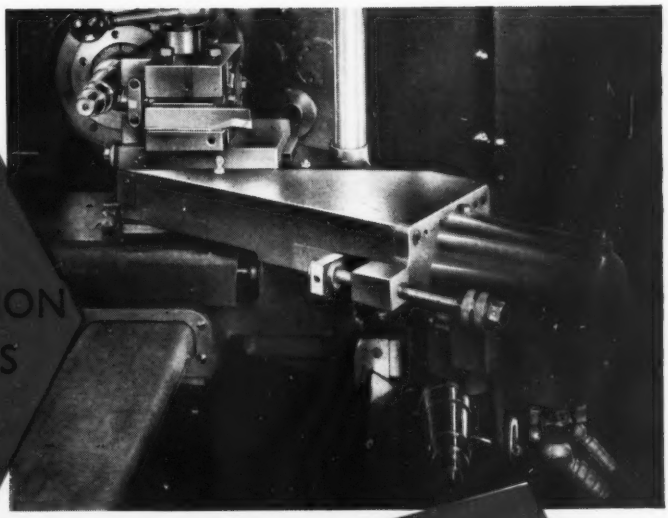

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With

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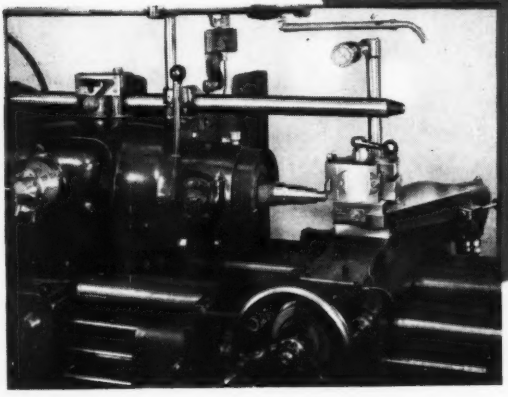
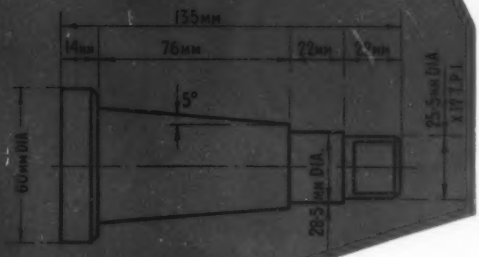
THIS COMPONENT
4·75 MINUTES FLOOR TO FLOOR





By courtesy of Messrs. H. W. WARD & Co. Ltd.

CHECK WITH YOUR OWN PRODUCTION TIMES

AND SEND FOR DETAILS OF THE HEPWORTH HYDRAULIC COPYING ATTACHMENT. A FULL RANGE OF UNITS ARE AVAILABLE FOR EXISTING MACHINE TOOLS INCLUDING PLANERS, MILLING MACHINES, VERTICAL BORERS & LATHES UP TO 30 DIA. SWING.

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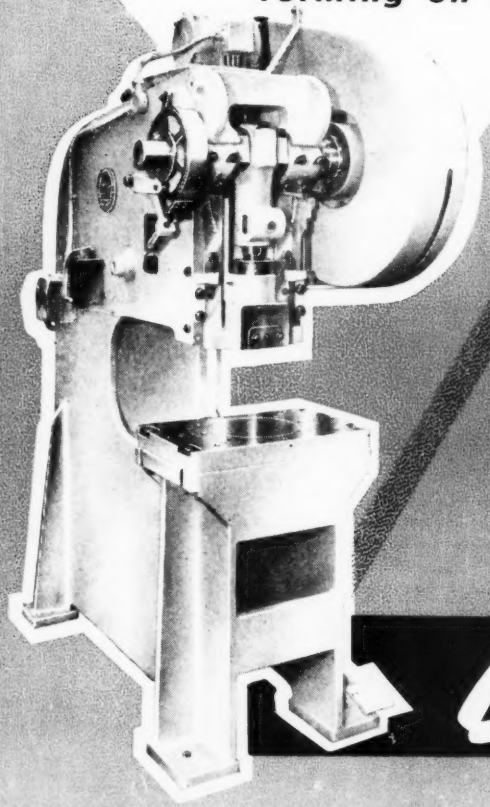
for high speed cutting, punching and forming on large wide sheets



Here is a new Bliss Press with features to boost production and cut operating costs. These presses have been designed for use where holes are to be punched or blanks cut at a distance from the edge of a wide sheet.
The range includes two bench models of 2½ and 5½ tons capacities and six floor models in capacity ranges 10-60 tons. All complete with parts interchangeable with Bliss Bench and Inclinable Presses of similar tonnages.
Standard features include: fully stress-relieved frame; rolling key clutch; extra long gibs and heavy duty precision-forged steel crankshafts.

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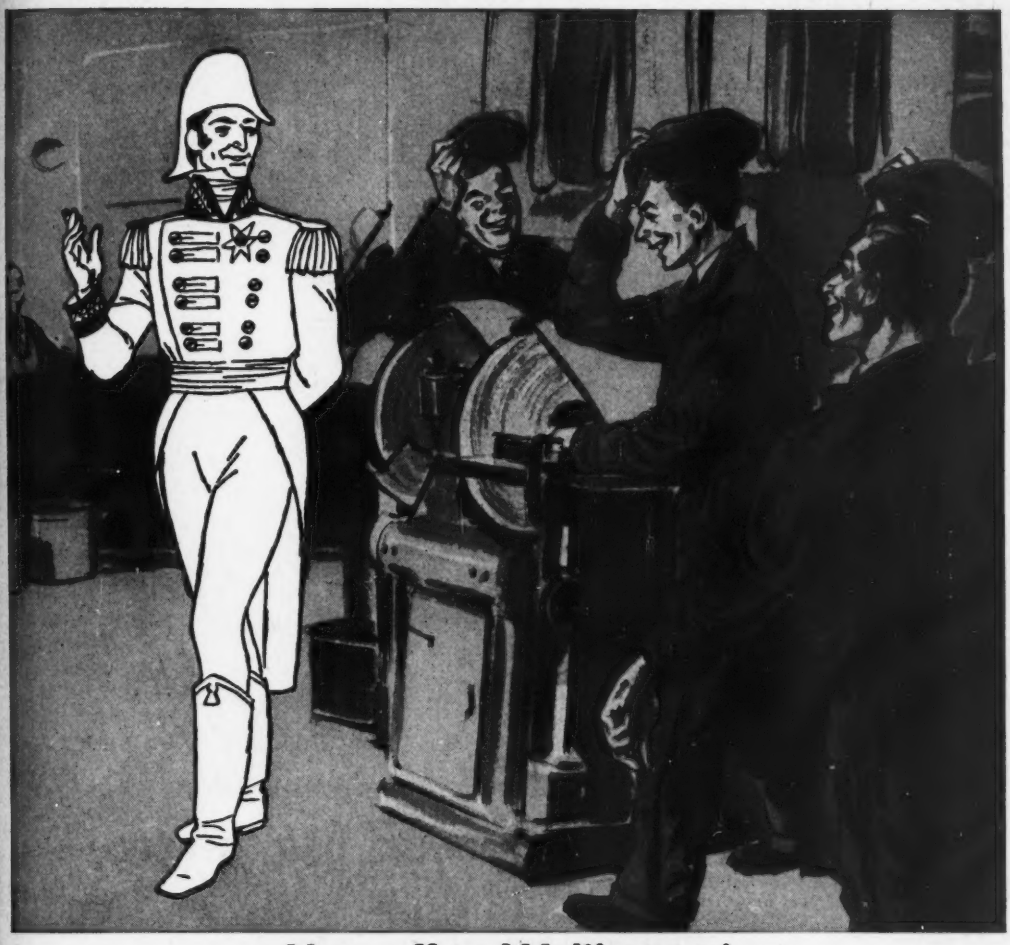

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In the finishing shop they're old hands, but none of them remembers a time when they weren't using the coated abrasives with the Wellington trade mark. They're Oakey abrasives—made by perfectionists *for* perfectionists.

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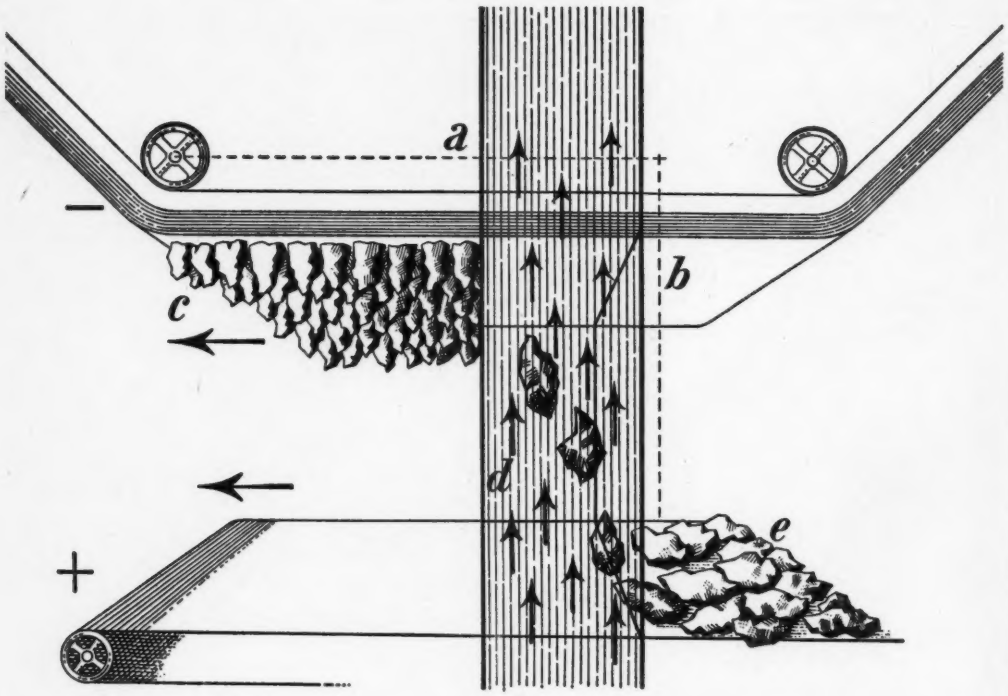

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YES a million cuts! And here's why

Every razor-edged grain in EAC abrasives stands bolt upright, presenting maximum cutting power to the work in hand. The grit, orientated on its longitudinal axis, is shot arrow-like into the adhesive by electrostatic force. That's why EAC abrasives literally bristle with cutting edges, work faster and last longer than ordinary makes. There's the right EAC abrasive for every operation. Insist on EAC for the best of good reasons—it saves money!

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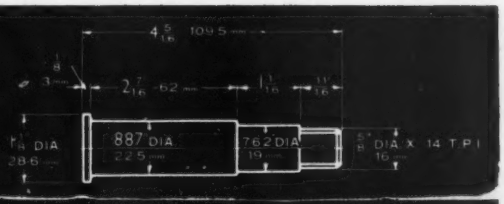

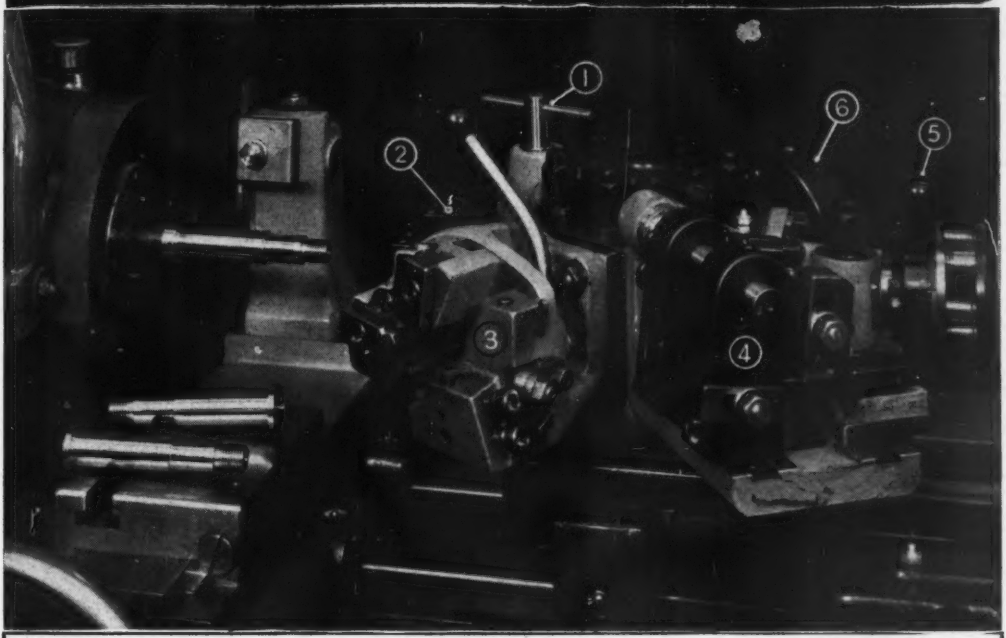

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1 1/16" dia. Steel Bar E.N.8.
40 ton Tensile Steel
Tungsten Carbide Cutting Tools.

2DS CAPSTAN LATHE

Code Word : **Tweds**

Fitted with 1½" Air Bar Chuck and Air Bar Feed.

Floor to Floor Time : 1 min. 45 secs.

DESCRIPTION OF OPERATION	Tool Position		Spindle Speed R.P.M.	Max. Cutting Speed		Feed	
	Hex. Turret	Cross-slide		Feet per min.	Metres per min.	Cuts per inch	m/m. per rev.
1. Feed bar to stop & close chuck	1	—	—	—	—	—	—
2. Centre drill	1	—	1110	—	—	Hand	Hand
3. Start turn	2	—	1110	343	104	Hand	Hand
4. Tangential roller turn ·887" dia.	3	—	1110	343	104	130	·195
5. Multiple roller turn 1⅛", ·762" & ·579" dias.	4	—	1110	343	104	130	·195
6. Thread roll ⅝"×14 t.p.i.	5	—	1110	181	55	—	—
7. Roller end and chamfer	6	—	1110	181	55	Hand	Hand
8. Tangential part off	—	Rear	1110	327	100	Hand	Hand

'PRELECTOR' Combination Turret Lathes with Preselective speed-changing.

TURRET LATHES with capacities up to 35 in. swing over bed

1½ in. to 3½ in. 'D-S' DOUBLE-SLIDE Capstan Lathes for heavier accurate work.

Stock Tools, Toolholders, Chucks and Accessories for Capstan and Turret Lathes.

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ASSOC. BRITISH MACHINE TOOL MAKERS LTD

W684
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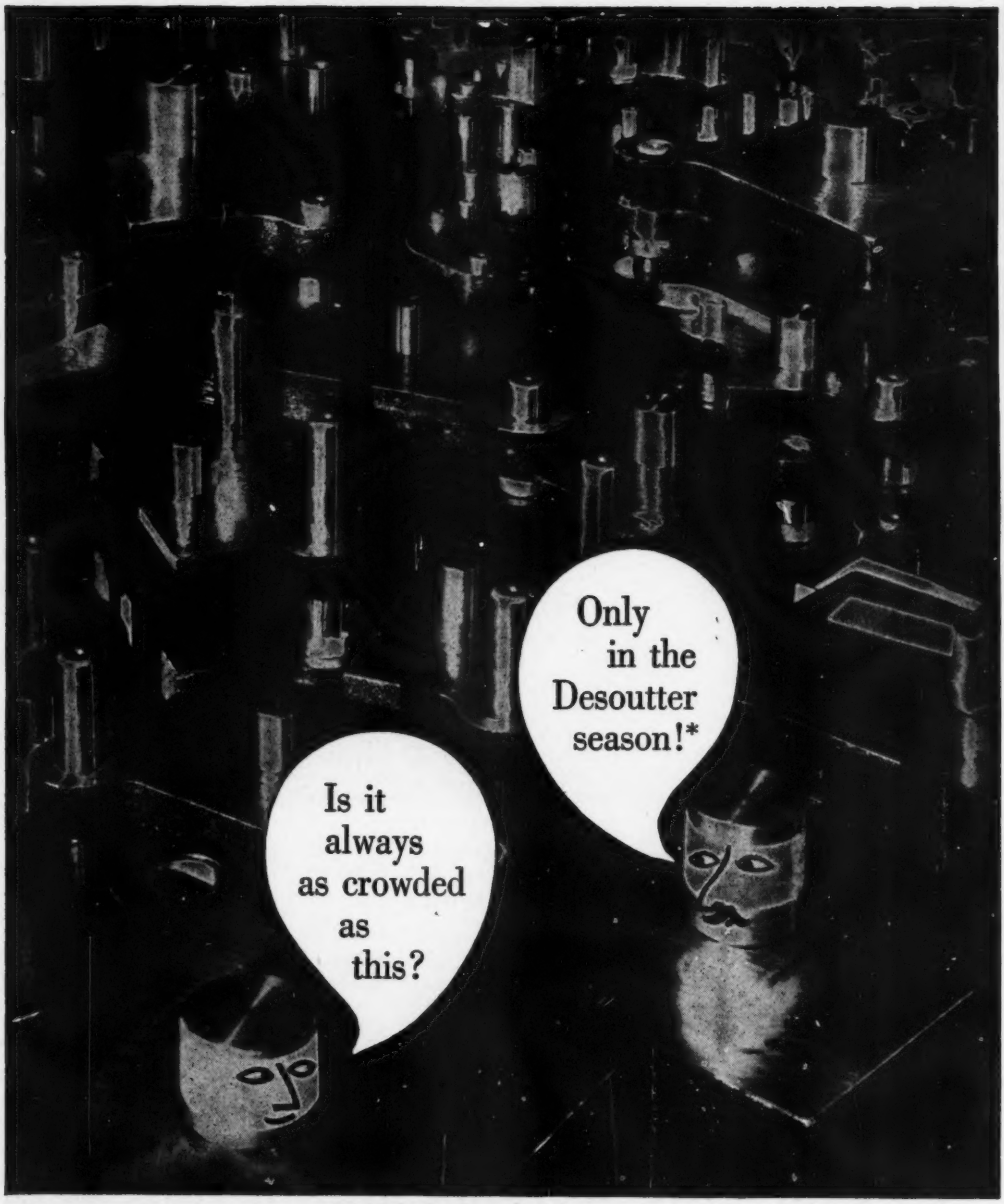

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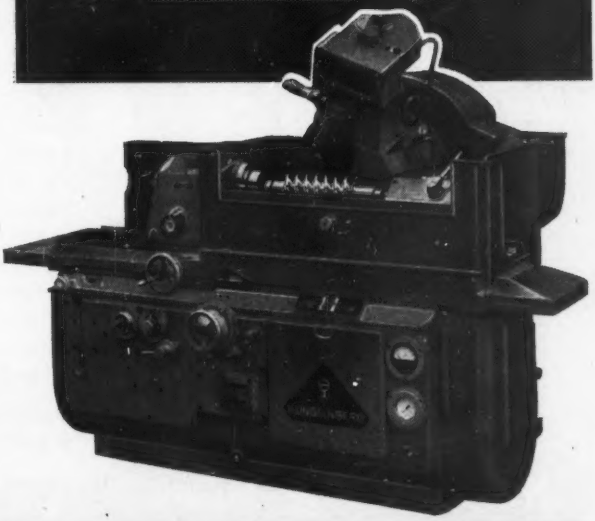

MODEL HSS 33 B

Automatic Worm Grinding Machine enables you to obtain the increased efficiency, longer life and higher load capacity which result from the use of hardened and precision ground worms.

Single or multi-start worms, in a wide range of size and pitch can be economically produced to an exceptionally high standard of accuracy and finish.

The redesigned wheel dresser employs a single sided template to profile both sides of the wheel simultaneously with mirror-image accuracy.

Extreme flexibility in operation is an important feature of Model HSS 33 B; the workpiece can be machined during both forward and reverse strokes and the two flanks may be ground simultaneously or individually.

BRIEF SPECIFICATION

Workpiece diameter	From ¾ in. to 12¾ in.
Pitch range	1 to 50 D.P.
Number of starts	1 to 10
Max. Lead angle	40°
Lead range (4 T.P.I. Leadscrew)	$\frac{1}{16}$ in. to 10 in.
Lead range (2 T.P.I. Leadscrew)	$\frac{1}{16}$ in. 20 in.
Max. Length:	
Worms between centres	28¾ in.
Shaft worms (up to 3½ in. shank diameter)	43¾ in.
Max. Length ground:	
up to 30° lead angle	17¾ in.
up to 40° lead angle	16½ in.

The capacities given above for Lead and number of starts can, in certain cases, be increased.

Fully detailed information available on request.

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Hythe Works, The Hythe, Staines, Middlesex. *Telephone* Staines 55474 (5 lines) *Telegrams* Sytool Staines

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to EN Specifications.

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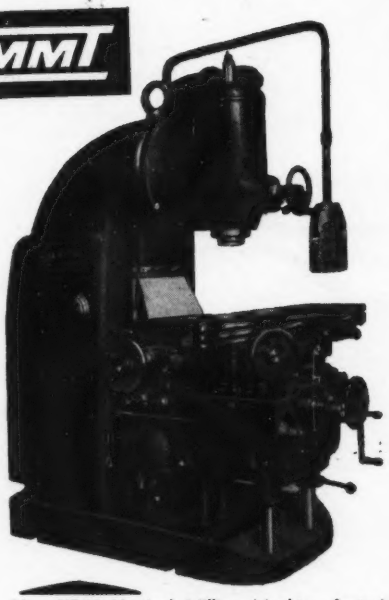


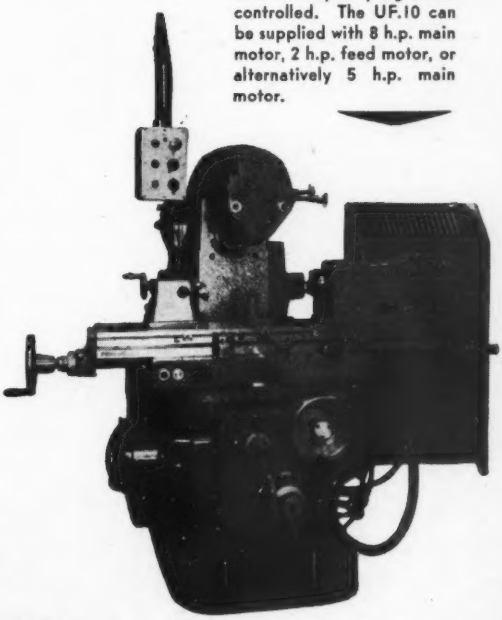
New VF.20 Vertical Milling Machine featuring the swivelling head with independent motor drive for power feed to quill, enabling power feed of quill to be obtained at any angle desired. This is a valuable feature especially in repetitive drilling and boring. Main spindle motor 15 h.p., feed motor 3½ h.p., special feed motor for spindle quill ½ h.p.

KÖPING

MILLING MACHINES

Lead the Field!

The UF.10 illustrated with automatic cycle programme control including rise and fall of knee and indexing. All machines supplied with double front support to knee giving maximum support under the heaviest cut. Range includes universal, plain, vertical, auto-cycle and auto-cycle programme controlled. The UF.10 can be supplied with 8 h.p. main motor, 2 h.p. feed motor, or alternatively 5 h.p. main motor.



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NRP 5061

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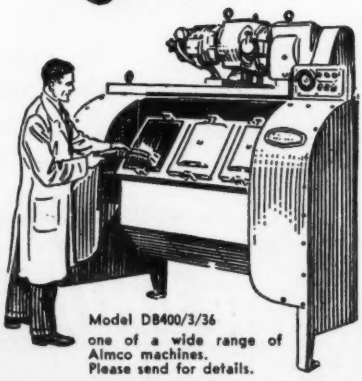
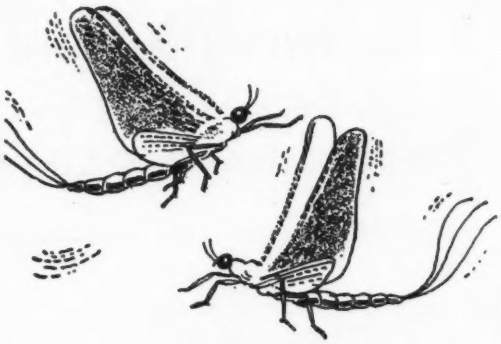


Model DB400/3/36 one of a wide range of Almco machines. Please send for details.



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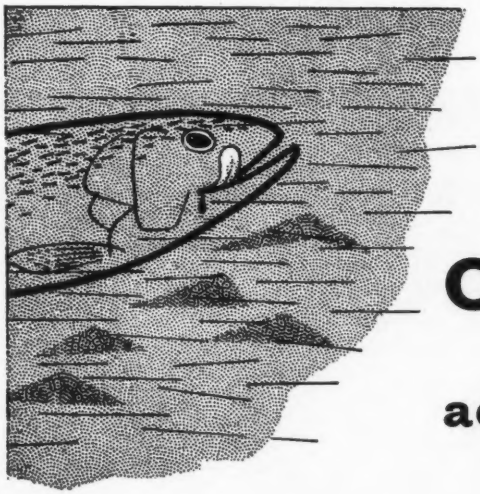

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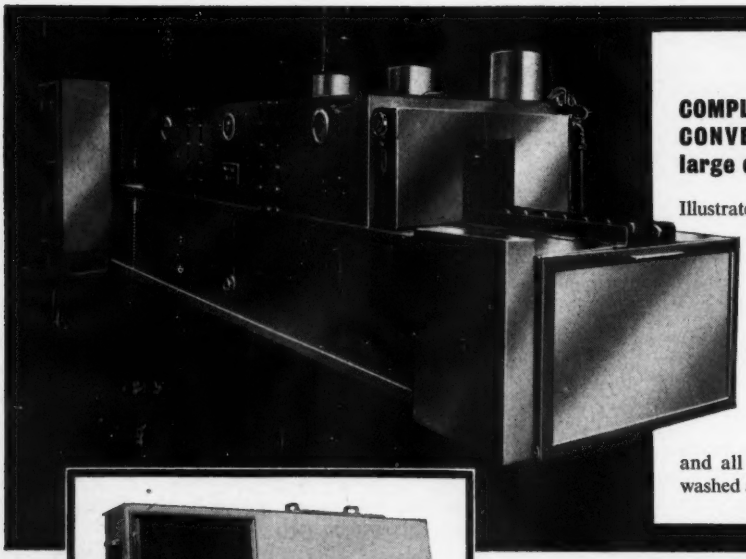

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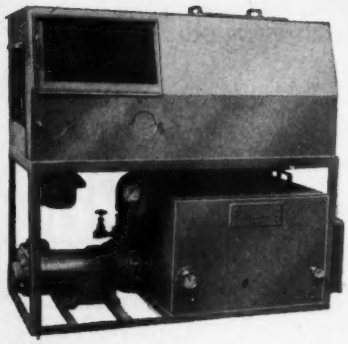

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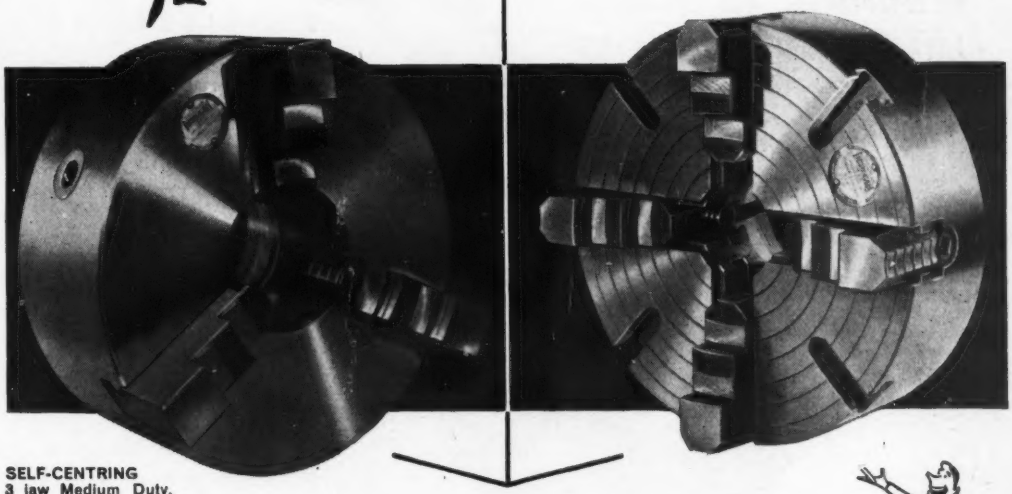

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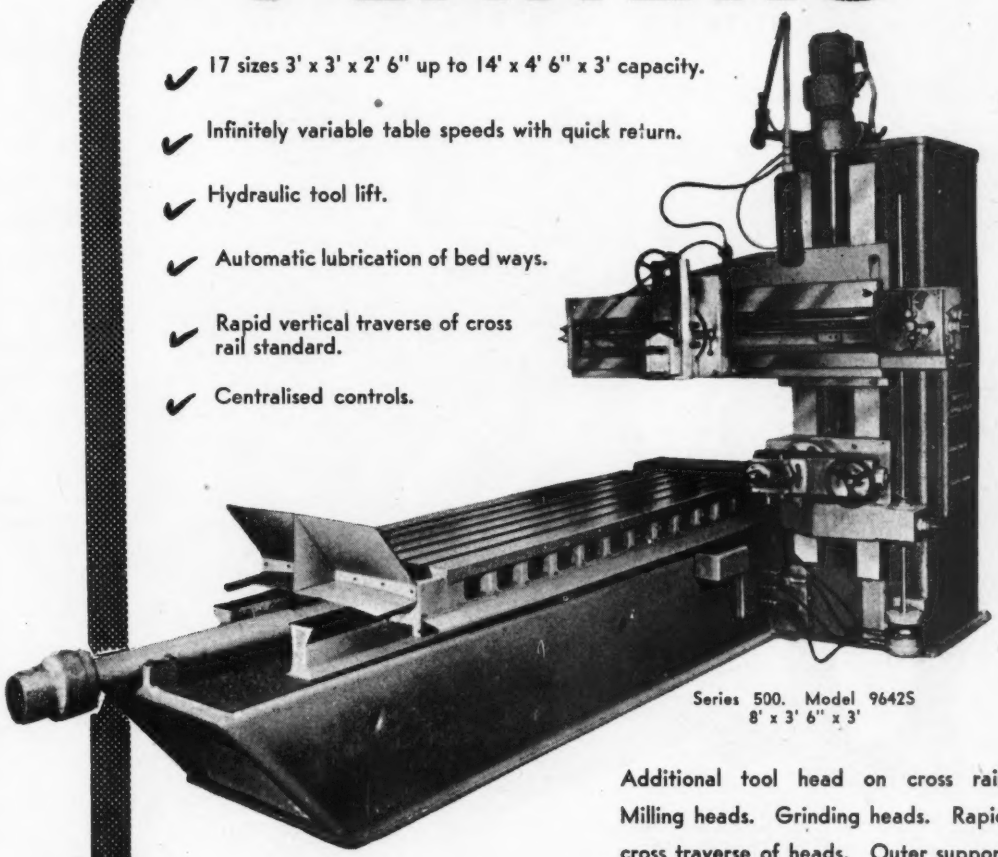

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8' x 3' 6" x 3'

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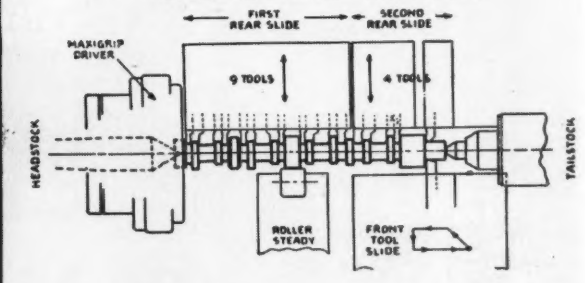

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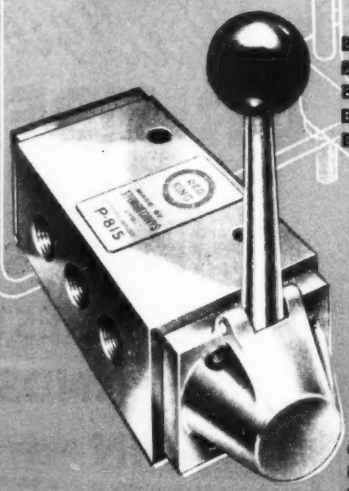

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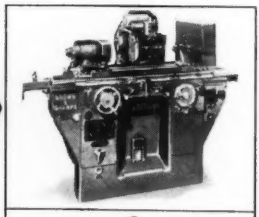
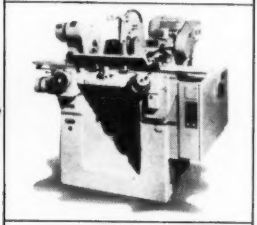
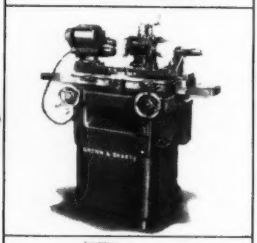


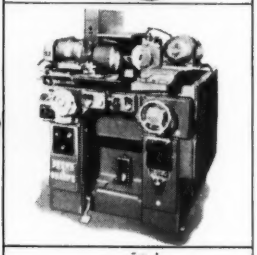
No. 5 PLAIN GRINDER



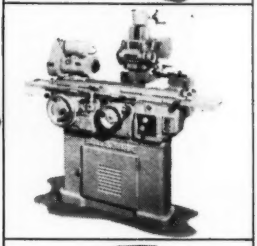
No. 10 N CUTTER & TOOL GRINDER



No. 11 FACE GRINDER



No. 13 UNIVERSAL & TOOL GRINDER



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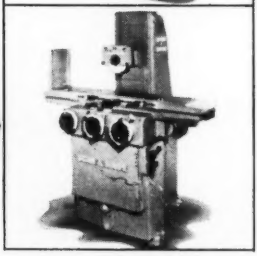

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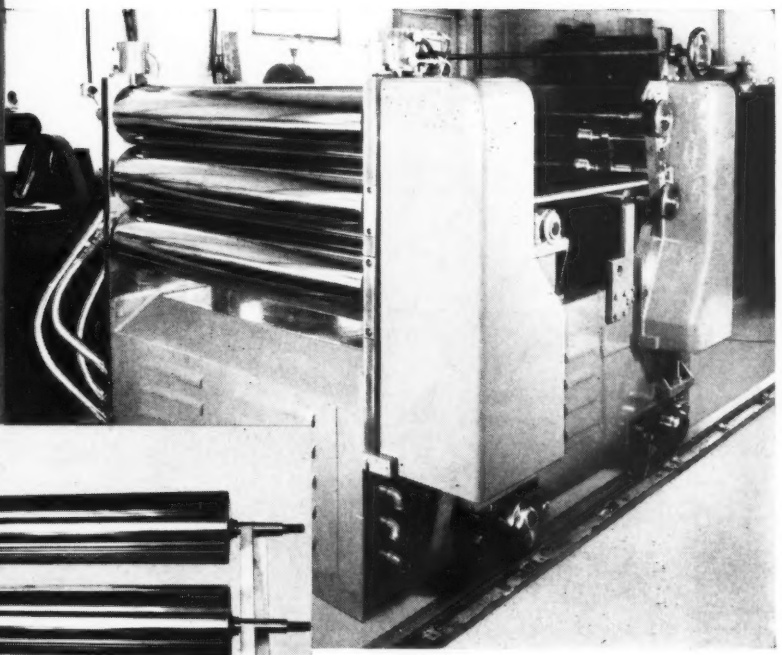

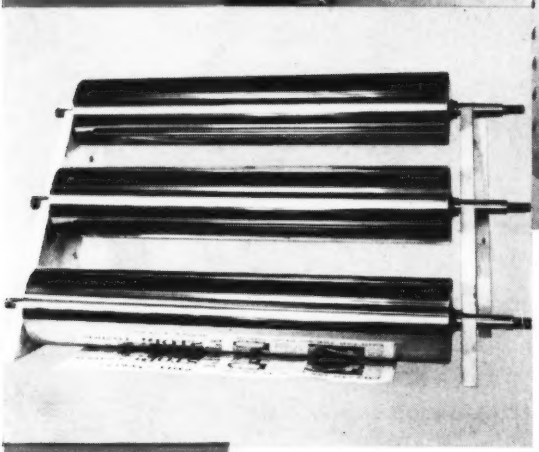

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ISRAEL
Middle East Mercantile Crpn. Ltd., 9, Union Court, Old Broad St., London, E.C.2.

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Jorgen C. A. Ammentorp, Buen 531, Vesterbrogade 6, Copenhagen 5.

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Ingg. Scotti & Garrone, Via Palestrina 33, Milan.

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Oy Machinery A B P.O. Box 129, Helsinki.

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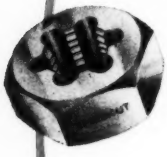
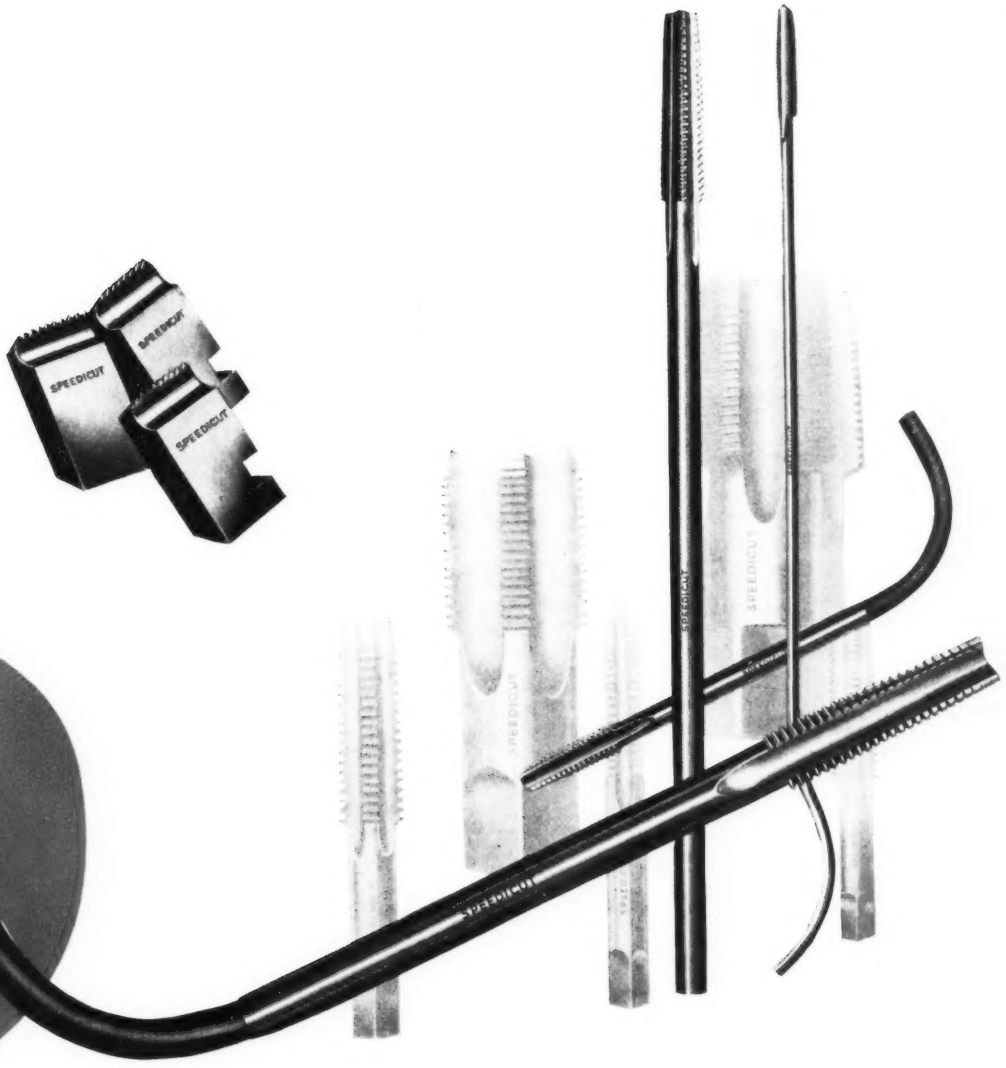


FIRTH BROWN TOOLS LIMITED



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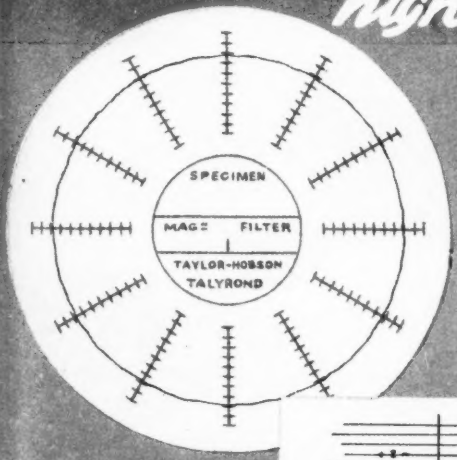

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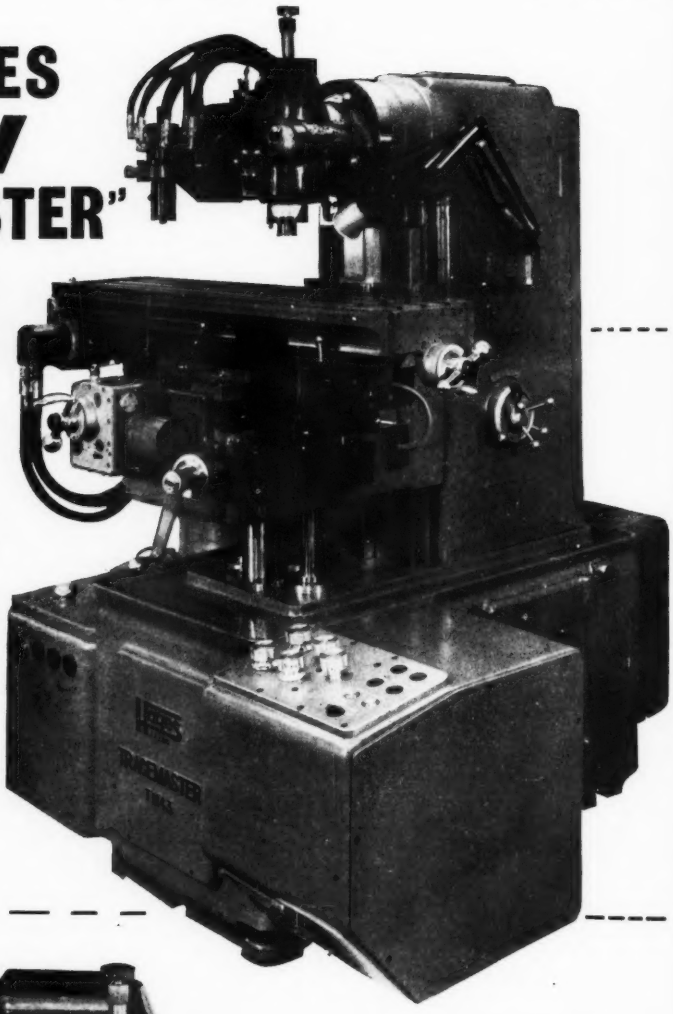

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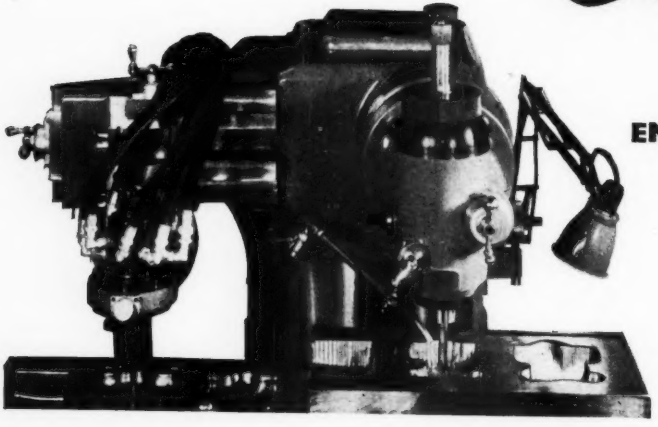

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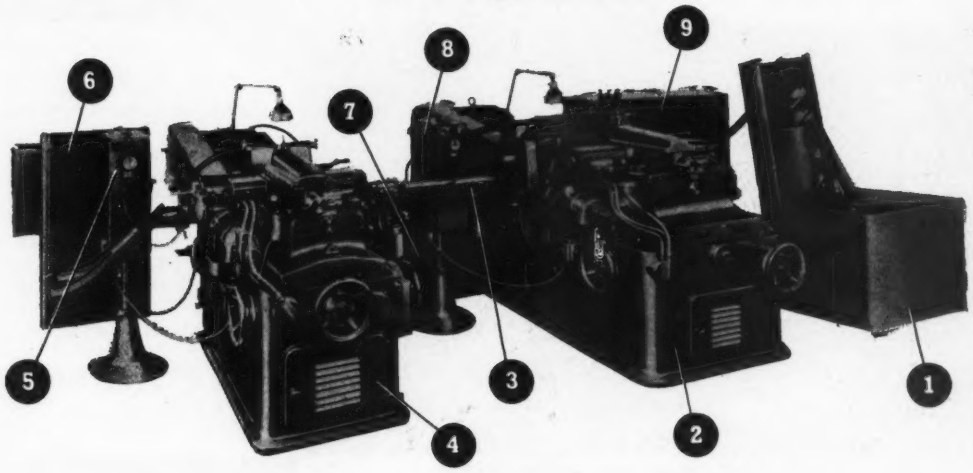

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Lidkoping Centreless Grinders can be incorporated in a link line arrangement such as that illustrated above for rough and finish grinding gudgeon pins and similar work. An elevator type automatic feeder loads the first machine, and a chain conveyor connects to the second machine. A third machine can be introduced into the arrangement if required and would be another No. 46 type grinder.

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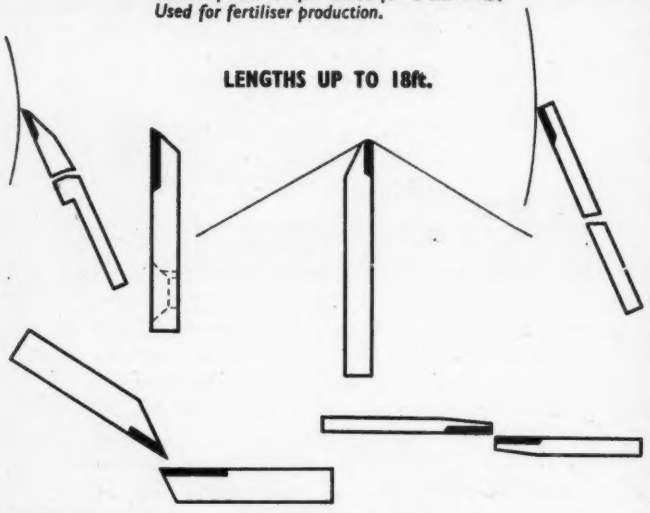

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- QUICK DELIVERY

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ADMIT BETWEEN CENTRES 3ft. 9in. or 5ft.
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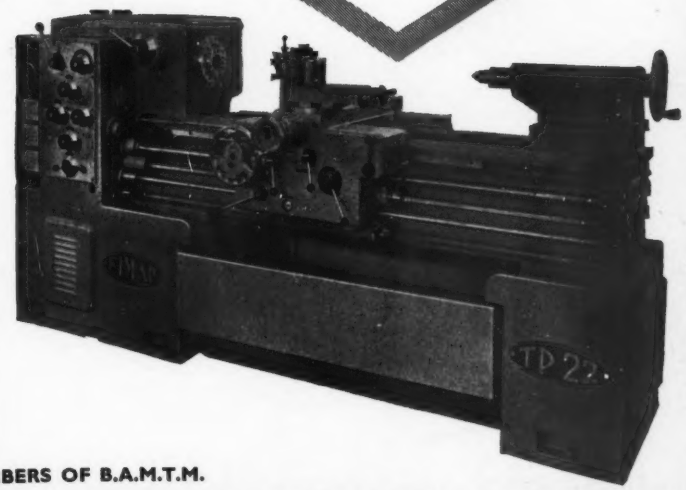
SWING IN GAP ..... 20¾in.
SPEEDS.....20-1600 r.p.m. or 30-2,200 r.p.m.

FULL DETAILS SENT ON REQUEST



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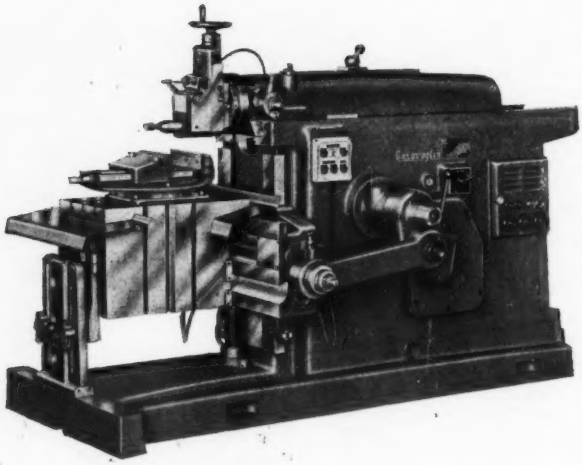


Maximum stroke	24¾ in.
6 speeds—s.p.m.	14 to 150
Size of table	23⅜ in. × 15in. × 15¾ in.
Maximum distance ram to table	14½ in.
Longitudinal traverse	24¾ in.
Vertical traverse	12½ in.
H.P. of Motor	8

Sizes range from 17in. to 28in. stroke.

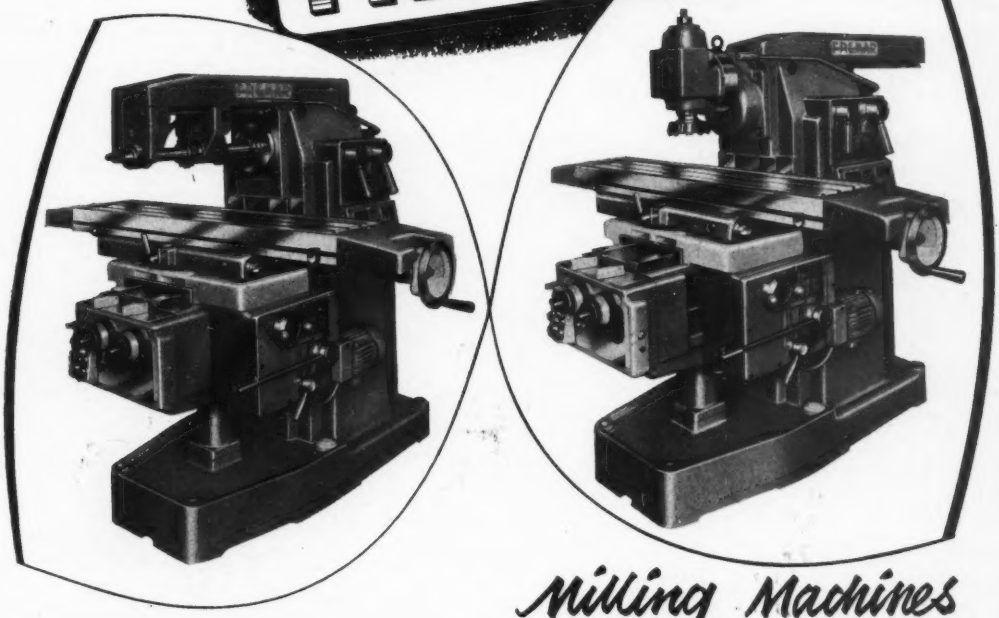
Early delivery

HERBERT WIDDOWSON & SONS LIMITED

Canal Street Works, Nottingham. Tel: 51891 (4 lines) Grams: TOOLS, NOTTINGHAM

Introducing the

FREMAR



Milling Machines

Features include:— Hardened and ground gears. Power feeds and Quick Power Traverse in all directions. Vertical Milling Attachment. Speeds up to 1,530 r.p.m.

Brief specification:—

	Model No. 2	Model No. 3
Working surface of table	51¼in. × 11¾in.	60in. × 30in.
Longitudinal traverse	33¼in.	42in.
Cross traverse	9¾in.	9¾in.
Vertical traverse	15¾in.	15¾in.
Spindle nose	No. 50 N.S.	No. 50 N.S.
12 Speeds—R.P.M.	35 to 1,520	35 to 1,520
PRICES: complete with 400/3/50 electrics and Standard equipment	**£1,825**	**£1,745**

Standard equipment includes:—Vertical Milling Attachment, Arbor Braces, Coolant Equipment, etc.

Special Terms to Members of B.A.M.T.M.

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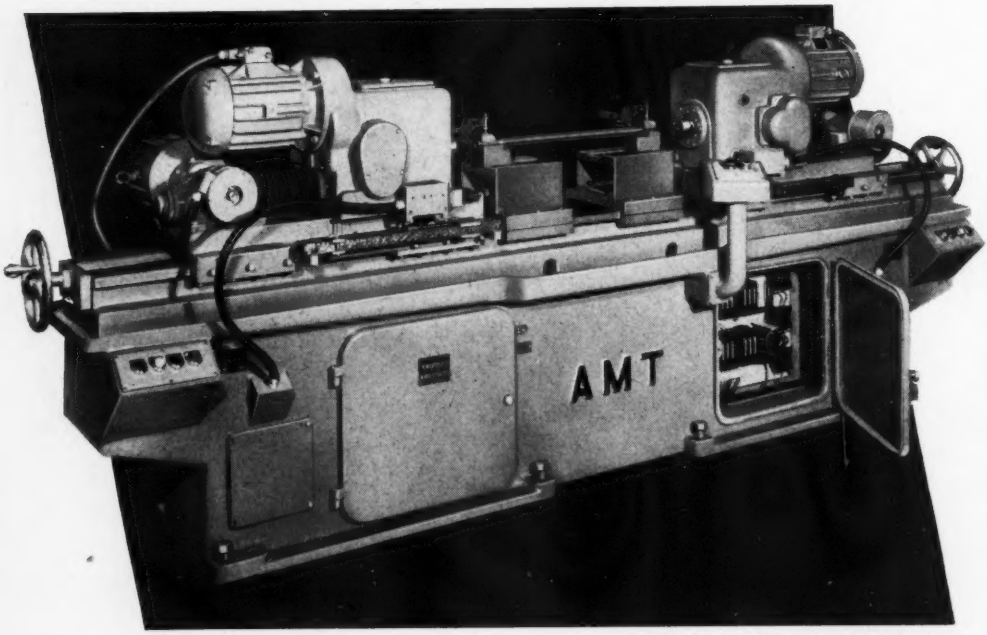
ANOTHER EXAMPLE OF

AMT UNIT HEADS

INCORPORATED INTO A VERSATILE 2-WAY DRILLING MACHINE—



Photograph by courtesy of Accles and Pollock Ltd.

Double Ended Machine incorporating two A.M.T. DI Units of 2 H.P. Capacity, each unit separately adjustable on the base to accommodate lengths of components up to 48 inches in length. Each unit can be individually or collectively operated on the following cycles:

DRILLING, COUNTERBORING, JUMP GAP DRILLING AND TAPPING

BROCHURE ON REQUEST **A.M.T. (B'HAM) LTD.,** Bournbrook, Birmingham 29
Telephone : SELly Oak 1128/9/20. Telegrams : AMTOLD, BIRMINGHAM

Yes, we've installed Burdett's

Why?

Read what my team says :—

Works Manager:
Sound engineering job: no maintenance worries.

Production Engineer:
Output all-time high.

Operator:
Couldn't be easier to handle.

Inspector:
Accuracy consistent.

Cost Accountant:
Production costs never better.

Accountant:
Price is right: obviously built to last.

Sales Manager:
Quality production = customer appeal.

MODEL 70. 18 x 6.
Acknowledged to be the most powerful 18 x 6 Surface Grinder made. Capable of the heaviest stock removal and at the same time, the best possible surface finish and the highest accuracy.

MODEL 75. 24 x 8.
Heavy cuts will not disturb the settings of the specially designed spindle and bearings. All working parts fully protected and serviced with ease.

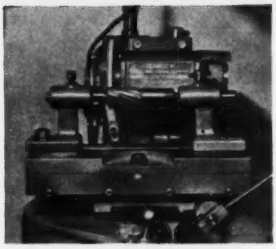
MODEL 77. 24 x 12.
Latest addition to the range. Has all the features of the other models plus extra grinding width for dies and press tools.

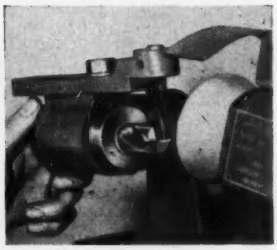
G.W.S. BURDETT & CO. LTD.
EASTGATE PETERBOROUGH
Telephone 4871

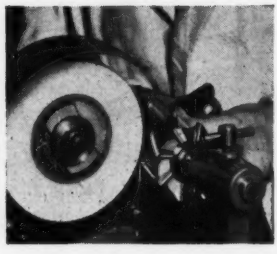
Who knows more about

CUTTER GRINDING

than cutter manufacturers?







Ideal for resharpening End Mills, Slot Drills, Woodruff cutters, T-slot cutters, Counterbores, Countersinks, Side and Face cutters, Cylindrical cutters, Face mills, Angle cutters and many other types.

The men who make cutters know the best methods of keeping them in good condition. That's logical. Clarkson make the finest cutters and offer to Industry their own design of Cutter Grinder which is used exclusively in their works.

The Clarkson Cutter Grinder is front operated for maximum visibility. A built-in, adjustable lighting unit allows the operator to obtain concentrated, glareless light on any part of his work at any time.

The machine can be set and the cutters re-sharpened in 15 to 20 minutes, according to type. It is compact enough to be installed in any convenient corner of your works.

Speed, efficiency and ease of installation—what more do you need? A 'phone call or letter to your nearest Clarkson centre will bring you a fully descriptive leaflet on this versatile, yet reasonably priced Cutter Grinder.

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KING EDWARD ROAD
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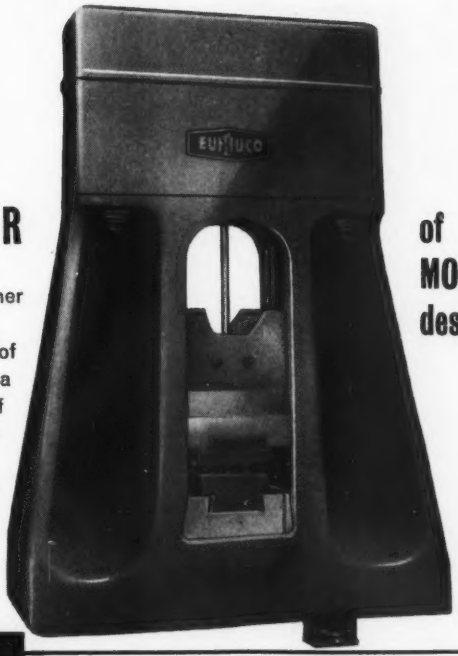
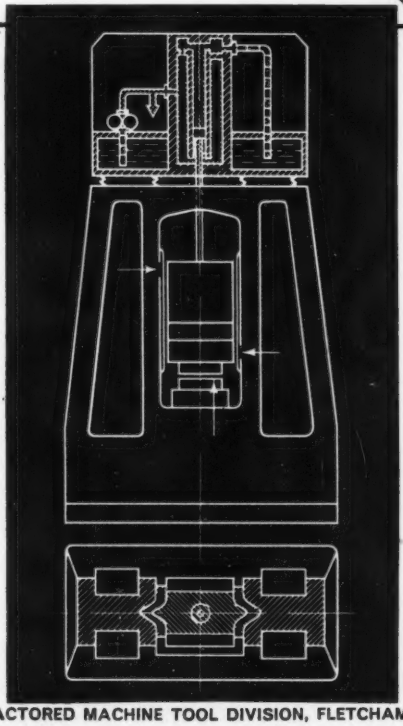
EUMUCO
LEVERKUSEN—GERMANY

PRECISION HAMMER

is a short stroke downward pressure hammer with oil-hydraulic rocker drive.
It was developed for mass production of precision forged components and is a natural addition to the Eumuco range of chain hammers of smaller size up to approx. 10 tons.
The experience gained in double shift operation over a period of more than a year has proved that the aim in designing this hammer has been realized.



of MONOBLOC design



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OILHYDRAULIC ROCKER DRIVE WITH DOWNWARD PRESSURE EFFECT, high efficiency (approx. 75%) without additional cooling by water or oil. Operating medium: non-inflammable hydraulic fluid or hydraulic oil.
Highly durable, unbreakable SHORT, BEND-RESISTING PISTON ROD.
ACCURATE, WEAR-RESISTING TUP GUIDE in the form of hardened and ground adjustable guide faces of great width and length.
LARGE CLAMPING AREAS for protecting the tup and anvil block insert, suitable also for taking die holders.
MONOBLOC DESIGN of the hammer superstructure, anvil block, column and upper cross piece form a single compact rigid steel casting, without any faces subject to wear or connecting pieces, but an anvil block with a large machined bearing face.
SIMPLE OPERATION by electric pedal switch control and universal programme control.

WICKMAN LIMITED

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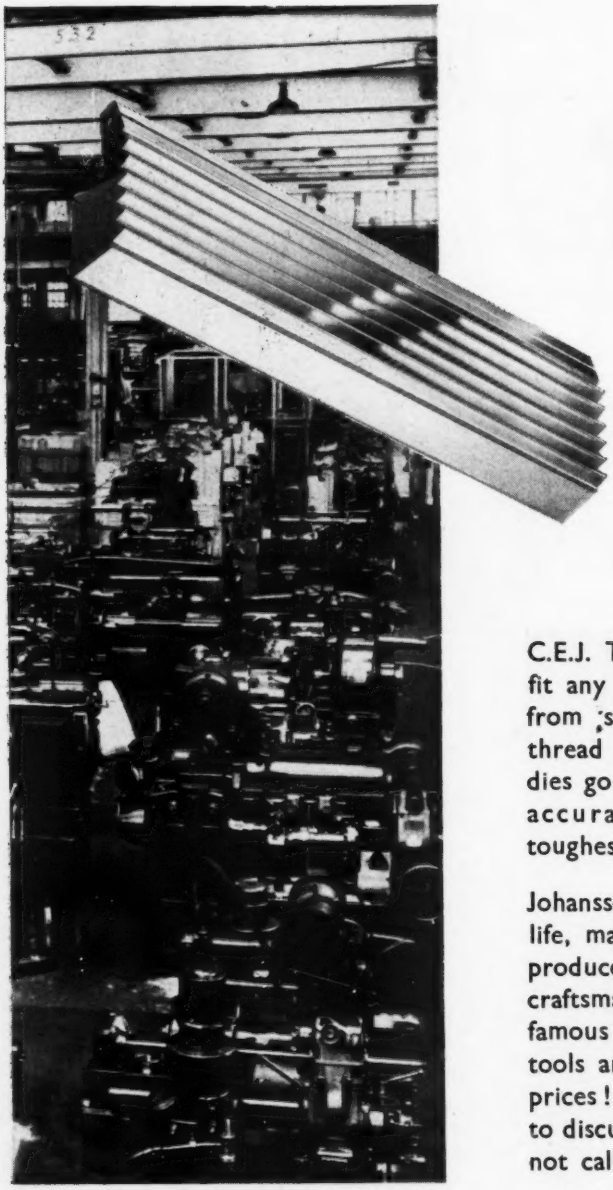

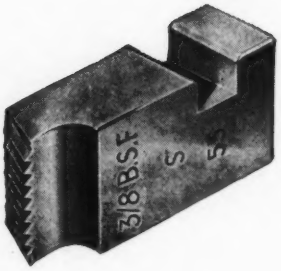

YOU GET THE FAMOUS "GAUGE BLOCK" QUALITY IN EVERY JOHANSSON THREADING TOOL

C.E.J. Thread Dies . . . made to fit any die head, readily available from stock in a wide range of thread types and sizes, Johansson dies go to work for you producing accurate thread forms in the toughest applications.

Johansson dies are made for long life, made for precision work, and produced with all the care and craftsmanship that lies behind the famous C.E.J. symbol, and yet C.E.J. tools are available at competitive prices! Our representatives like to discuss threading problems, why not call on their services?

CEJ JOHANSSON LTD.

Specialists in threading and precision measurement

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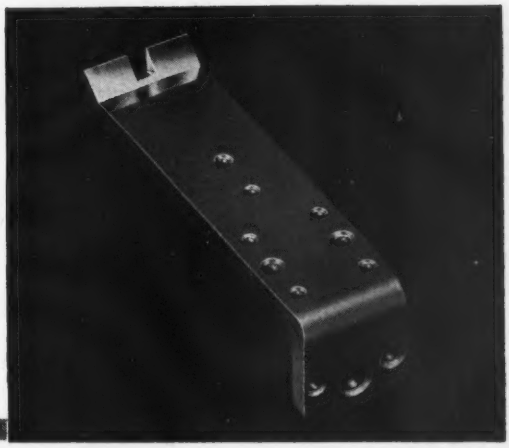
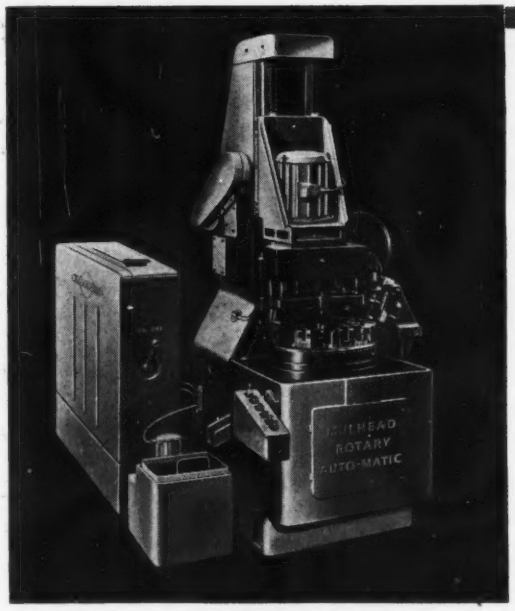


Pole Piece: 11 close-pitched holes drilled; 5 different diameters; 1 hole drilled and counter-bored from angular side-head . . . and the output rate is 300 per hour . . .

Working with the MULHEAD Mk IV ROTARY AUTOMATIC



Here is another example of the way in which this standard versatile machine 'pays for itself' by raising output and reducing costs. The Mulhead Mk. IV. may solve a production problem for you. Ask for a full specification.

Manufactured by
MULHEAD ENGINEERING Co. Ltd.

SOLE SELLING AGENTS:
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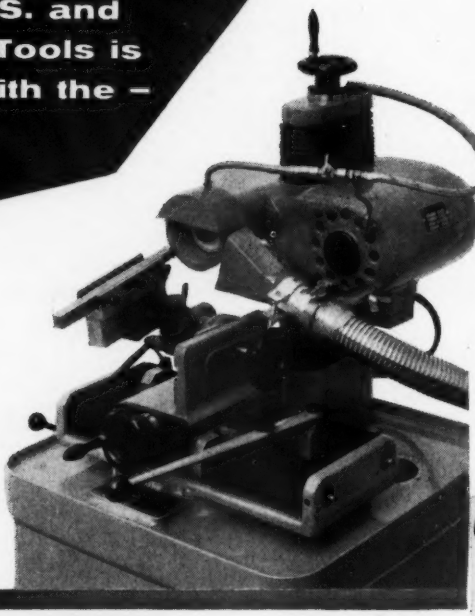
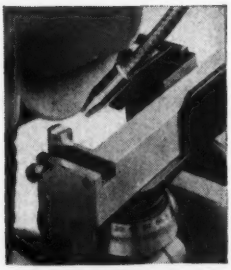
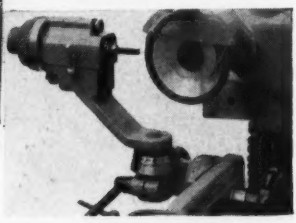
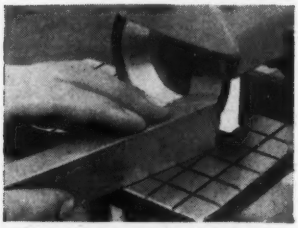




Grinding of Profile Cutting Tool



Indexing Head with Collet Chuck



Arrangement for Free-Hand Grinding

Set-up for Sharpening Reamers, etc.

... THOMMEN

TYPE SNS

CHIP BREAKER

and

CUTTER GRINDER

- ★ Handles rapidly and efficiently all types of lathe tools up to 1¼in. x 2¾in.
- ★ Simple to operate and capable of the most precise results.
- ★ With standard attachments can be used as an ordinary tool and cutter grinder.

Write for fully descriptive literature.

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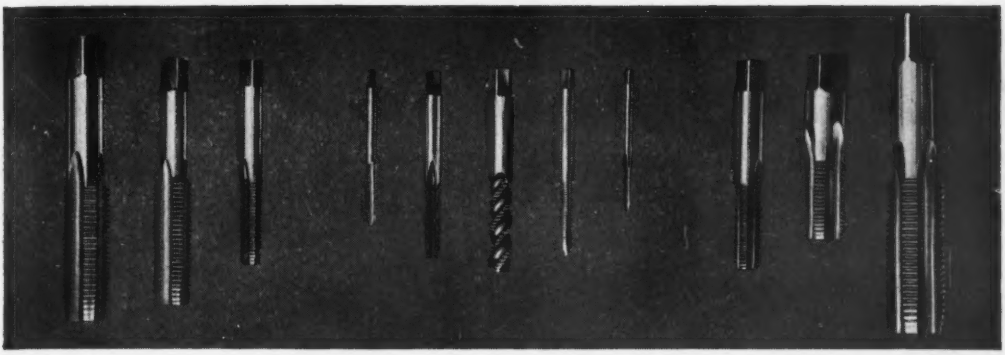
Telephone: VICTORIA 0370 & 5301



All these tap sizes on one machine

When it's a

MEDDINGS *Pacera*

First class thread from 10BA in any material to ½" in Mild Steel . . . ¾" in Brass . . . 1" in Aluminium and Zinc Alloy . . . with a Meddings Pacera Pitch Controlled Tapping Machine. *The* machine for high quality work at *your* price!

The secret?—easily interchangeable lead screws and lead screw nuts, with a specially developed pitch control attachment. No material is 'difficult' for these machines. Even with aluminium or perspex you can be sure of an accurately formed thread. Thin materials? You can tap 10 BA through $\frac{1}{32}$" material without any trouble at all. The machine comes in a variety of models, and there's a high speed version and a slower version of each. Accurate setting for top and bottom of tapping stroke—with cam-operated micro-switches. More than one hole to tap with the same thread? The machine is ideal for multi-spindle work. Lead screw and nut to your choice supplied with every machine.

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JONES & SHIPMAN

model 1014
UNIVERSAL
TOOLROOM
GRINDER

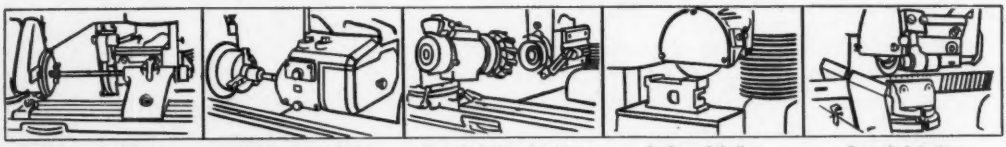
Built for High Quality external and internal grinding and designed to give extraordinary sensitive control.

The special type of wheelhead, with its deep throat capacity, and centralised position of wheel in relation to table permits a large surface grinder coverage (using hand cross traverse), and offers special facilities for broach grinding.

The extra Universal Cutterhead extends the operation of this highly accurate and versatile machine to cover tool and cutter grinding operations.

FEATURES

- Hand cross feed and vertical feed in ·0001in. increments
- Auto cross feed per reversal of table of ·0001in. to ·007in. over ·025in. (reduction in work diameter of ·050in.)
- Grinding wheels fitted on either end of wheel spindle.
- Vernier scales to wheelhead and table swivels.
- Fast cross traverse to wheelhead for setting purposes.



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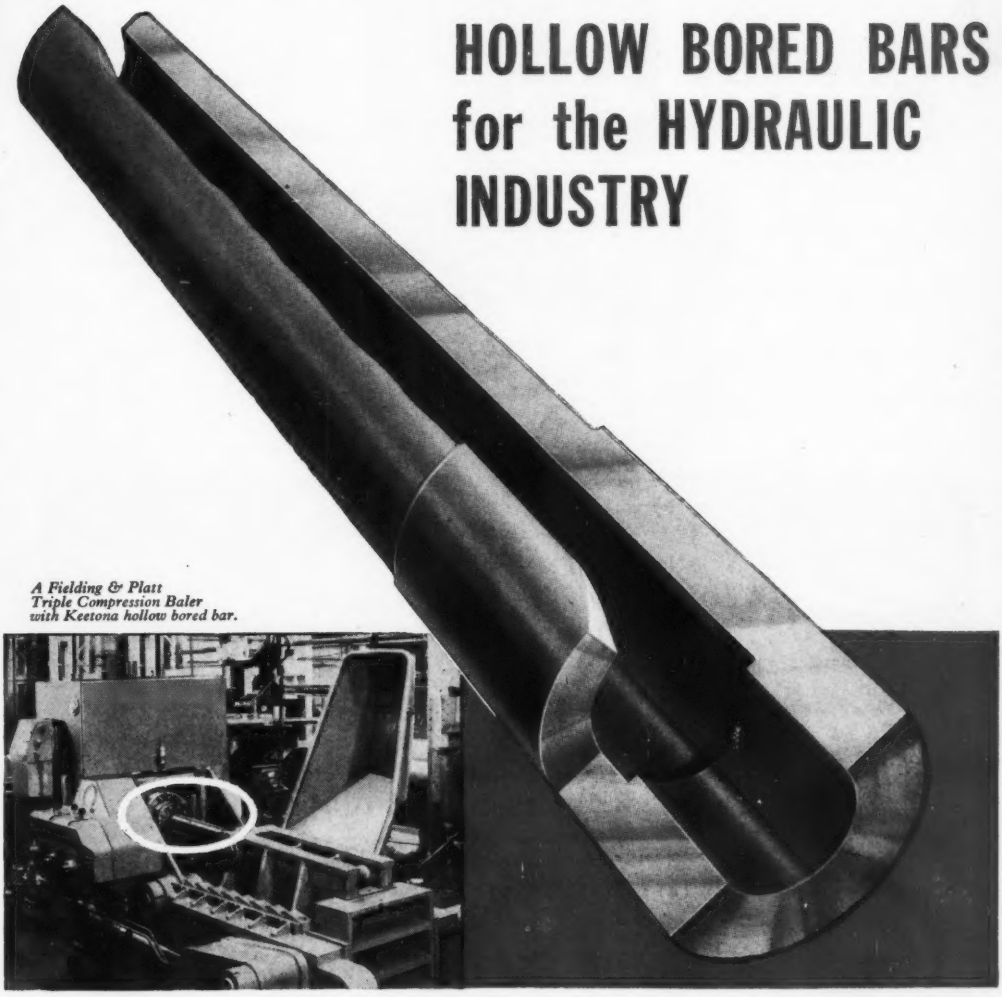
HOLLOW BORED BARS for the HYDRAULIC INDUSTRY



A Fielding & Platt Triple Compression Baler with Keetona hollow bored bar.

If there were no Keeton deep hole boring, these cylinders might have cost a great deal more. Keetons produce them as hollow bored bars, and they form part of the hydraulic equipment on Fielding & Platt Triple Compression Balers. Each cylinder is 4′ 9⅜″ long and accurately step-bored on the inside by deep hole boring. However tricky your order, or however small, Keetons can do a low-priced job *every* time. Keetons also specialize in finished boring and honing in a range of bores from 2″ to 8″. A new illustrated booklet gives full specifications of Keetona Hollow Bored Bars. Please write for your copy.

TRADE KEETONA MARK

HOLLOW BORED BARS

KEETON SONS & CO. LIMITED, KEETONA WORKS, GREENLAND RD., SHEFFIELD 9. TEL: SHEFFIELD 42961/4

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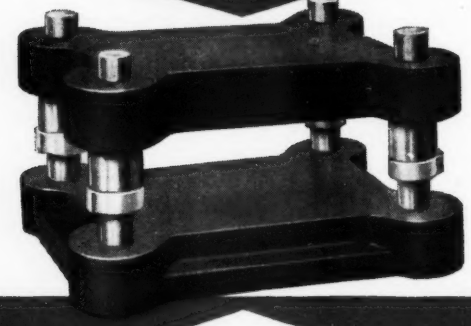
Are YOU tooling-up for long runs?



K E 970

2% CARBON 14% CHROME HIGH DUTY TOOL STEEL

WAS CHOSEN BY MESSRS DEXION LIMITED

for the dies and punches to produce their famous slotted angle. Millions of slots have been punched with the minimum amount of tool regrinds.

Illustration by courtesy of MESSRS. DEXION LIMITED.

May we tell you more about the properties of K.E. 970 and other K.E. tool steels?
The booklet shown below is available on request, free of charge.

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Stocks held at:- Carlisle Stee Works, SHEFFIELD 4. Tel.: Sheffield 22124.
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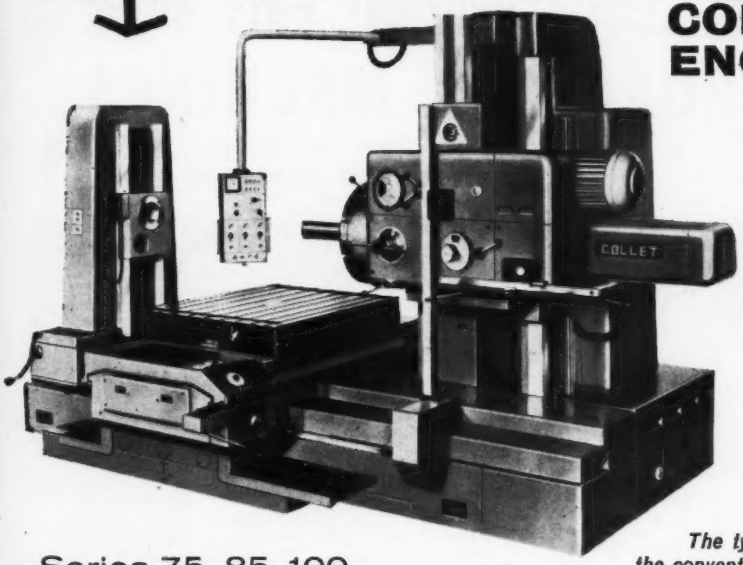
DID YOU MISS THIS AT OLYMPIA

The C&E

COLLET & ENGELHARD

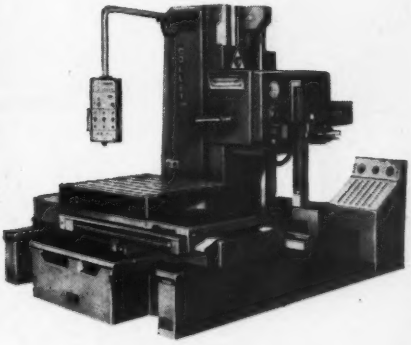
Horizontal Boring and Milling Machine



Series 75, 85, 100

New machines designed to meet the most exacting demands. New features include the provision of three types of Spindle Head giving the operator greater variety for milling and cutting operations. Many modern special attachments can be added to increase the efficiency of the machine.

The types BFf and BFfb are the conventional universal boring machine. The sturdy designs of the 3-way bed (or 5-way) and central vertical wall gives greater rigidity in the transverse plane.



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FACTORED MACHINE TOOL DIVISION, FLETCHAMSTEAD HIGHWAY, COVENTRY
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FIO 556

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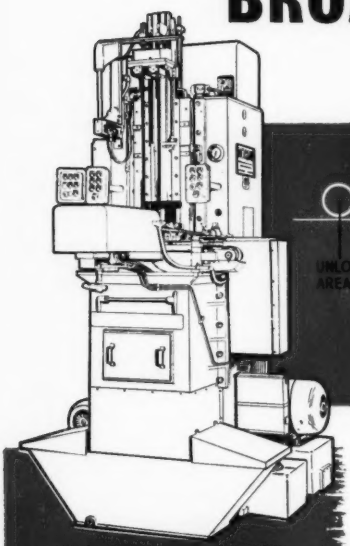
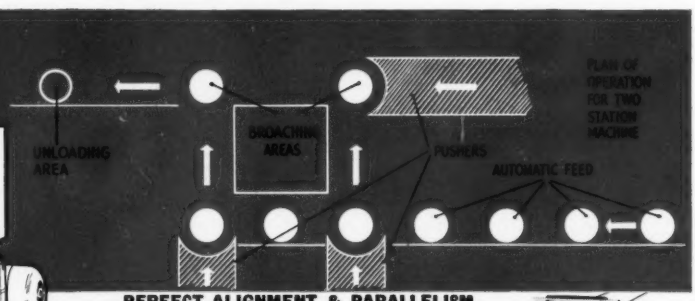
BSA DETROIT

MULTI-STATION

VERTICAL PULL DOWN BROACHING MACHINES

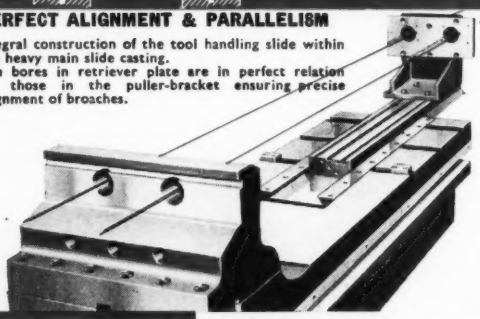
★ AUTOMATIC TOOL HANDLING
★ AUTOMATIC WORK HANDLING





PERFECT ALIGNMENT & PARALLELISM

ntegral construction of the tool handling slide within the heavy main slide casting.
The bores in retriever plate are in perfect relation to those in the puller-bracket ensuring precise alignment of broaches.



PULL DOWN PRINCIPLE
ensures
BETTER FINISHES
BETTER TOLERANCES
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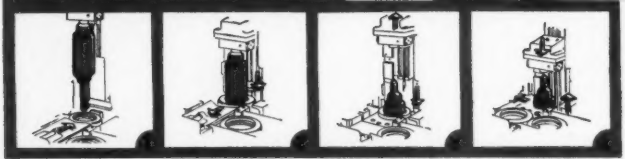

Part automatically positioned. Broach suspended.

Retriever lowered. Broach engaged in puller.

Broach passes through work; disengages from retriever when finish teeth have cleared the work.

Part automatically ejected. Broach returning to upper bracket.

B.S.A. Detroit pull down machines have every feature for ease in operation and accurate production: automatic tool handling, unique and accurate guidance of broaches, continuous engagement at both puller and retriever end, single or multi-station operation, positive lubrication.

Standard capacities:
5 tons, 30in. stroke, 35 F.P.M., to 50 tons, 72in. stroke, 20 F.P.M. (Cutting speeds variable.)

May we supply further details?

485

B.S.A. TOOLS LTD., BIRMINGHAM, 33, ENGLAND Cables: Broaching Birmingham

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Pressing... large & small in spring steel, mild steel & all non-ferrous metals
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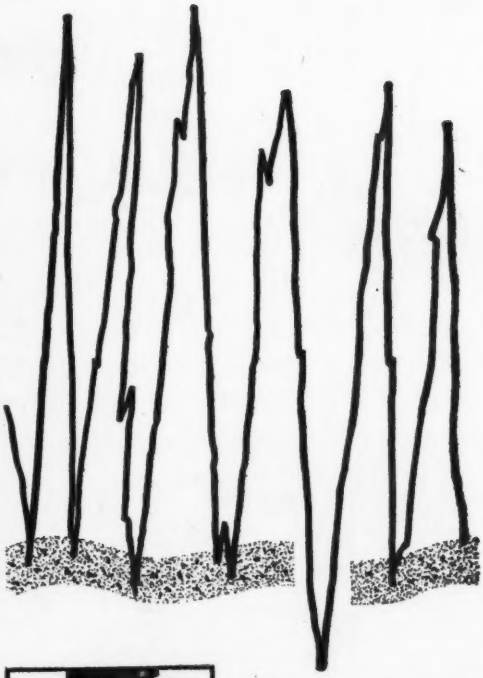

Imagine the reduction in nervous tension amongst your employees when you reduce vertical vibration by 80%. Imagine the reduction in machine wear, too. Yet an 80% reduction is perfectly feasible for many types of machinery with the Croid-Cooper method of installation, where the machine is simply stuck down on a felt base with a holding power of 80 lbs. to the square inch. May we send you details?

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OF MACHINE FIXING
DAMPS VIBRATION

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MACHINE FIXING GLUE

COOPERS
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FROM 6½" TO 16½" HEIGHT OF CENTRES

These machines are built out of a long tradition of craftsmanship to the highest modern standard of design, productive capacity and precision. There are sizes and types to meet your own needs. Ask us to send you details.

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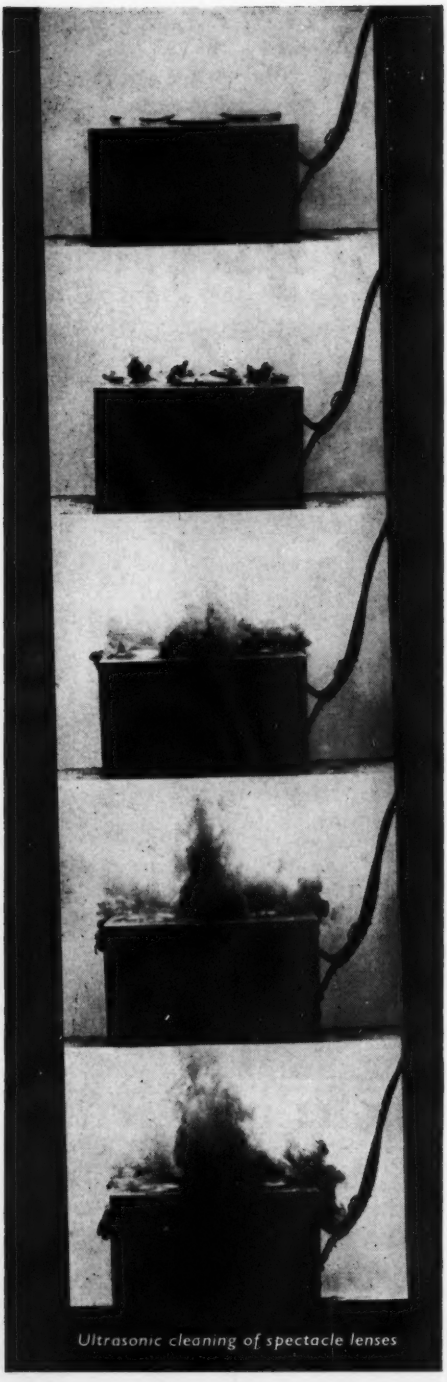

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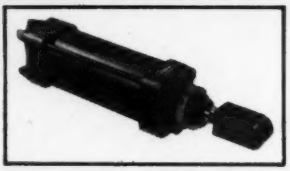

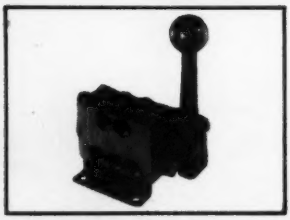

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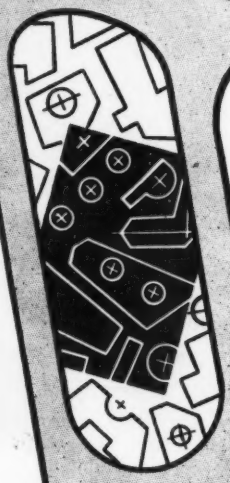

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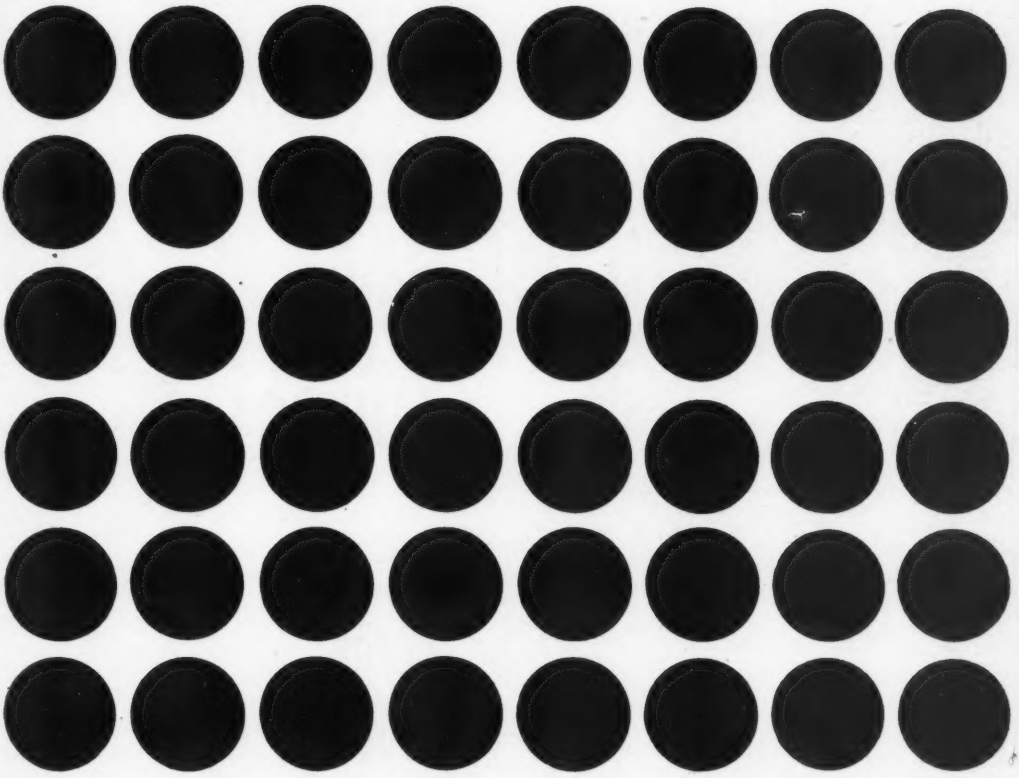

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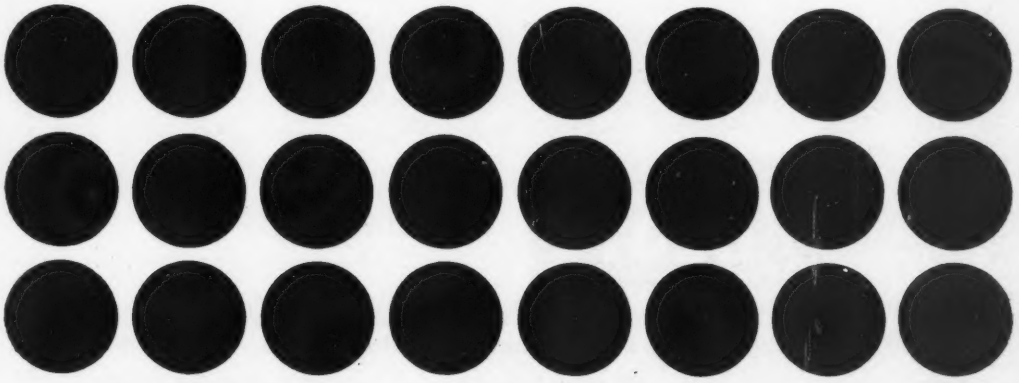

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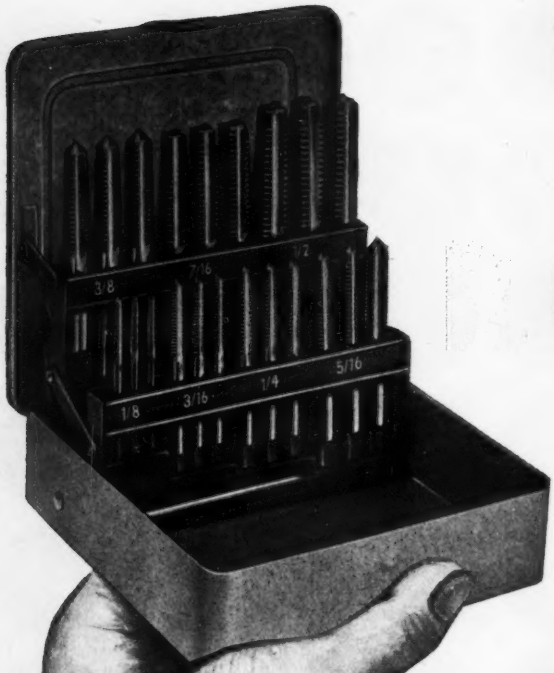

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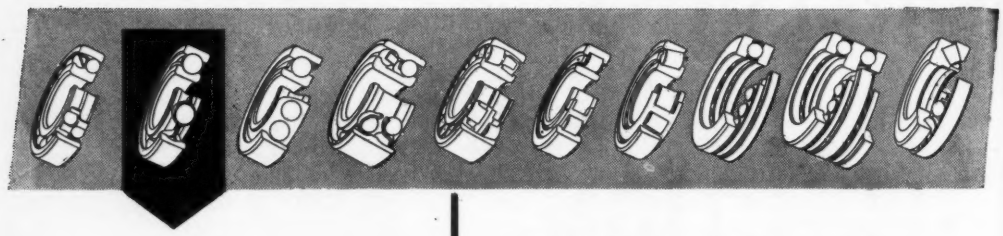

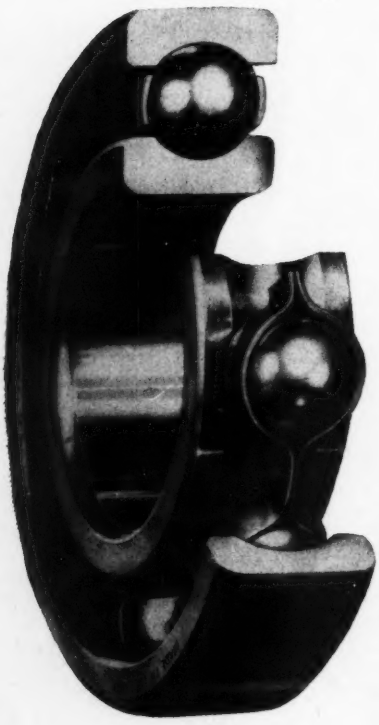

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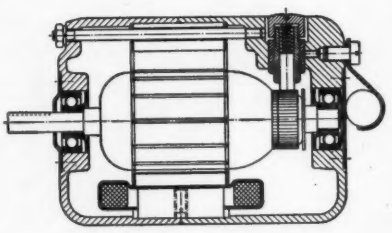

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Abstracts of Principal Articles

Producing Nuclear Components in Lead and Graphite .. .. P. 4

At the works of Graviner Manufacturing Co., Ltd., Fareham Road, Gosport, Hants., a variety of nuclear engineering work is undertaken, which includes the production of items in 4 per cent antimonial lead, and the machining of graphite. One major project, in which the firm recently participated, was the Canadian Z.2 reactor, for which they machined the entire graphite structure, comprising some 2,500 blocks. This undertaking necessitated the design and construction of a large special-purpose machine, capable of machining diameters up to 16 ft. Lead bricks for radiation barriers are produced for the U.K.A.E.A. in large quantities, and for this work, a special lead casting plant has been installed. For the machining of chevron type bricks, the company has also designed and built a special-purpose 3-station milling machine, with multi-spindle heads mounting profiled cutters. Lead spheres, for handling-tong ball-joints, are cast in graphite moulds, and are subsequently coated with Monel, by flame-spraying, followed by finish turning. (MACHINERY, 98—4/1/61.)

Bryant Type B Centalign Internal Grinding Machine .. .. P. 15

Developed by the Bryant Chucking Grinder Co., Vermont, U.S.A., the type B internal grinding machine is intended specifically for operations on miniature and instrument bearing races. It will accept work with a maximum outside diameter of 0·406 in., and will grind ball tracks and bores in parts with minimum outside diameters of 0·1 and 0·0437 in. The machine has a special wheel-head which incorporates a high-frequency spindle with a maximum speed of 150,000 r.p.m. A feature of the design of the wheel-head is that the axes of the traverse and feed motions coincide with, or pass through, the spindle axis, with the result that very accurate control of the wheel path is obtained. Details are also given of special "packaged" tooling units which are used in conjunction with the machine and provide for automatic loading and unloading of the workpieces. (MACHINERY, 98—4/1/61.)

The Production of the SIMCA Aronde P. 18

In this article, the tenth in a series devoted to the practice of the French SIMCA organization, reference is made to the methods employed in the small press department, where 76 machines of different types are installed. Wide use is made of mechanical work-handling units, and various types of loaders and unloaders are provided. Jib cranes are installed for handling coiled material, and the machines include a U.S. Multi-Slide unit for the production of captive nuts. The nuts are hopper fed into a pressed-up retainer, after they have been deburred. (MACHINERY, 98—4/1/61.)

Fluid-form Hydraulic Forming Attachment for a Power Press .. .. .. P. 34

Developed by Svenska Aeroplan, A.B., Sweden, the Fluid-Form attachment is intended for mounting on a conventional power press, to facilitate drawing components in dies with fairly deep cavities of intricate shape. Pressure for blank holding and forming is derived from a plunger mounted on the drawing slide, through a quantity of hydraulic fluid and a rubber diaphragm in the bore of a cylinder attached to the blank-holder slide. With another arrangement, the workpiece metal may be wrapped over a punch, and forming is then carried out against the action of a blank holder, operated by an air-hydraulic cushion. (MACHINERY, 98—4/1/61.)

The Production of Domestic Vacuum Cleaner Components .. .. .. P. 38

In this second article, concerned with some of the current production methods employed at the Perivale factory of Hoover, Ltd., reference is made to typical examples of presswork for the firm's type 1334 and 652 domestic upright vacuum cleaners. A recent addition to the equipment of the press-shop is a Schuler 9-station transfer press of 125 tons capacity, which is employed for producing components in aluminium, and mild steel in thicknesses up to 0·128 in. Operations performed on this machine include the formation of closed "box" sections. Among components produced on a U.S. Multi-Slide machine are brass brush-holders, which are noteworthy for the close tolerance on the square-section bore, and the manner in which the corner-joint is formed by a series of interlocking castellations. These components are produced at the rate of 85 per min. (MACHINERY, 98—4/1/61.)

IN FORTHCOMING ISSUES

Producing components for domestic lawn mowers—The cold hobbing of hot-working steels.

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

Communication Systems for Production Departments

In view of the high cost of many modern machine tools and other items of production equipment. it is becoming increasingly important to ensure that the potential output capacity is utilized as effectively as possible. Particularly in a large machine shop or other manufacturing department, an examination of the results obtained may reveal that there is a considerable overall loss of output due to intermittent and unpredictable short-period interruptions in the operation of various machines. Much of this loss may be attributable to delays in the transmission of information by the operators of the machines which are temporarily idle, to enable necessary corrective action to be taken, and it appears that improvements could frequently be obtained by providing suitable internal communication systems.

It may be recalled that such systems are being used with very good results in certain die casting plants, where, apart from the importance of maintaining output over a given period, regularity of operation is highly desirable in the interests of product quality. A typical system, which may be applied, for example, to trimming presses as well as to die casting machines, provides for automatically recording each working cycle on a moving paper chart at a central control point, also for operating a counter. In this way a continuous record of the performance of each machine is provided, and it is possible to observe, at any time, not only the number of cycles that has been completed, but also the degree of regularity that has been achieved. In addition, facilities are afforded for indicating the reasons for interruptions by dialling numbers, in accordance with a code, on an instrument installed adjacent to each machine.

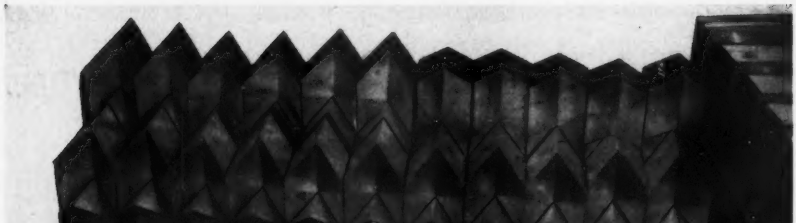
The system outlined is, of course, also directly applicable to press and machine shops, and where the speed of operation is such that it would be impractical to record each cycle, provision can be made for marking the chart for, say, every five or ten components produced. In some circumstances, however, certain additional refinements may be desirable. For example, an installation which has recently been provided in one of the factories of a leading manufacturing organization in the U.S.A., apart from recording output, as described, enables the operator of each machine to signal for help, when necessary. In addition, there is a socket into which a portable telephone set, carried by the foreman, can be plugged, so that when he has been summoned, he can conduct a 2-way conversation with the control room, without delay. Red and green signal lights, and a key-operated "down-time" switch, are also provided at each machine, as part of the communication system.

If an operator requires to draw attention to the fact that he is running short of material or that there is an accumulation of machine parts, or if he requires assistance because of a tool or machine failure, he can signal the control room without leaving his post. The foreman is then informed, and as soon as he reaches the machine he can take the necessary action to avoid or minimize any interruption of production. If some delay is inevitable, a signal is transmitted to the central recording installation by means of the "down-time" switch.

It will be appreciated that the main functions of this system are to provide a continuous indication of the performance of each machine and to enable the operators to signal the control room whenever the need arises. Additional advantages are, however, afforded by the fact that provision is also made for signalling from the control room to the machines. Thus, the insertion of a plug in a socket provided in a panel in the control room ensures that when the entire system is energized at the beginning of a shift, a signal light on the corresponding machine indicates to the operator that it is in order for him to start production. Similarly, when the required quantity of a given part has been completed, a signal is transmitted to the machine which indicates that production should stop. In this way it has been found possible to eliminate under-runs or over-runs.

When the system here briefly discussed was first applied to an installation of single- and multi-spindle automatics on which production runs are comparatively short, investigation showed that whereas setting-up occupied a fairly constant proportion of the total time available, approximately the same amount of time was lost while machines were waiting to be set up. With the facilities now available, however, it has been possible to reduce waiting time very considerably. Once the principle of direct communication between individual machines and operators and a central control

(*Continued on page* 52)



The Production of Nuclear Components in Lead and Graphite

Methods Employed by Graviner Manufacturing Co., Ltd.

By S. C. POULSEN, Associate Editor

IN ADDITION TO ACTIVITIES connected with their comprehensive range of fire and explosion protection equipment, Graviner Manufacturing Co., Ltd., whose factory is situated at Fareham Road, Gosport, have the necessary plant and equipment to undertake a variety of nuclear engineering work. This work is conducted mainly on a "jobbing" basis, at the Gosport works, at which the facilities available include plant for the casting and machining of bricks and other items in 4 per cent antimonial lead; a well-equipped clean-conditions shop for machining graphite; an extensive weld-fabrication shop; and a large general machine-shop.

Major nuclear projects in which the company has recently participated have included the Canadian Z.2 reactor, for which they produced the entire graphite structure. This undertaking afforded a good example of the type of skilled "improvization" that is often necessary to meet the exacting and widely-differing demands of nuclear engineering, and for which the company's work, in this field, is noteworthy. The graphite structure for the Z.2 reactor has an internal diameter of 135·28 in., ±0·030 in., an external diameter of approximately 16 ft., and an internal height of 125·27 in., ±0·090 in. It is built up, layer upon layer, from 2,500 blocks, each 8 in. thick, ±0·002 in., and 8 in. wide, ±0·010 in. The lengths of the blocks range from 10 in., ±0·030 in., to 32 in., ±0·030 in. In the floor, which is of similar construction, there is a central circular aperture, of 60·07 in. diameter, +0·010 in., −0·000 in., to receive a corresponding graphite "bung" of 60·00 in. diameter, + 0·000 in., −0·010 in.

In addition to the milling of the blocks to the sizes indicated, the production of this structure entailed the design, construction and installation, by the company, of the large special-purpose machine shown in Fig. 1, for machining each layer of blocks, in turn, to the required internal radius. As may be observed, the machine (since dismantled) was of a centre-column design, with an articulated radial arm which was driven round the column. Coarse adjustment to the working radius was obtained by means of the link *A*, which was provided with a series of holes for various alternative settings, and fine adjustment by means of the nuts *B*, on a screwed extension on the outer end of the link. This extension was arranged to pass through a pivoted lug on the outer arm, which carried the

cutter-head *C*. The head could be moved vertically on a slide, by means of a feed-screw and handwheel *D*, and the spindle was driven directly, at 2,860 r.p.m., by a 1½-h.p. 3-phase motor. A 2-h.p. motor, in conjunction with a 30:1 worm reduction gear, and a sprocket-and-chain final drive system which provided a further reduction, served to rotate the arm.

To obtain a flat surface on which to support the work, a circular lead "mat," 2 in. thick, was cast directly on to the shop floor, surrounding the pit in which the base of the column was accommodated. This mat was then faced and levelled with a fly-cutter mounted on the spindle of the machine, and a similar type of cutter, with two blades, and a diameter of 10 in., was employed for machining the blocks, which were clamped to the datum surface by means of rubber-faced planks secured by bolts in the shop floor. As each "course" of blocks was completed, the individual blocks were marked in accordance with a code numbering system, and the course was then dismantled, for reassembly in a trial assembly area. Here, the complete structure was built-up, course by course, as a check, before shipment and final assembly on site. The machining of each course was completed in approximately 1½ working days.

PRODUCING LEAD BRICKS

Lead bricks, for the construction of radiation-proof barriers, are produced by the company, in considerable quantities, on behalf of the U.K.A.E.A., and are of various sizes, which are designated in accordance with the wall-thickness afforded by each particular "system." The overall range comprises bricks for 2-in., 4-in., 7-in., 9-in. and 10-in. systems, and for each system, the various joint-faces of the bricks are profiled so that they interlock. In addition to providing structural stability in the assembled barriers, these profiles ensure that radiation, which travels in straight lines, cannot pass through the joints between adjacent bricks. The 2-in. and 4-in. systems are based on a chevron configuration, whereas the profiles in the 7-in., 9-in. and 10-in. systems are of a "humped," radiused form, resembling a flattened Greek letter omega.

In the 2-in. and 4-in. systems, each standard brick has flat parallel sides, an external 90-deg. vee at one end, and a corresponding internal vee at the opposite end. Similar vees are provided on the upper and lower faces. The length and depth of each brick, as measured between the apices of the vees, are equal to the lateral thickness, between the parallel sides. In addition to the basic standard

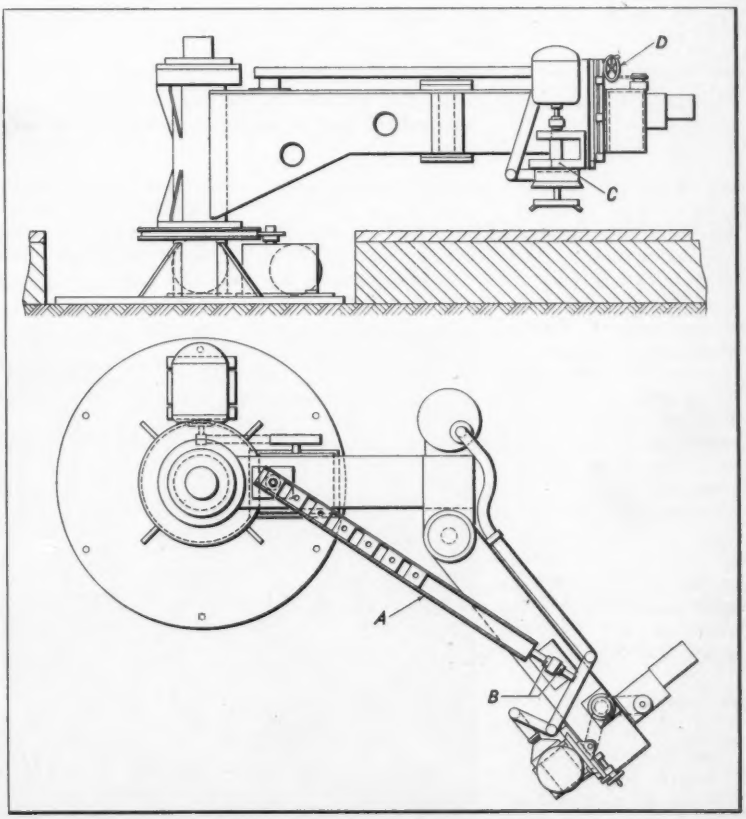


Fig. 1. This special-purpose machine (since dismantled) was designed and built by the company for machining the graphite structure for the Z.2 reactor

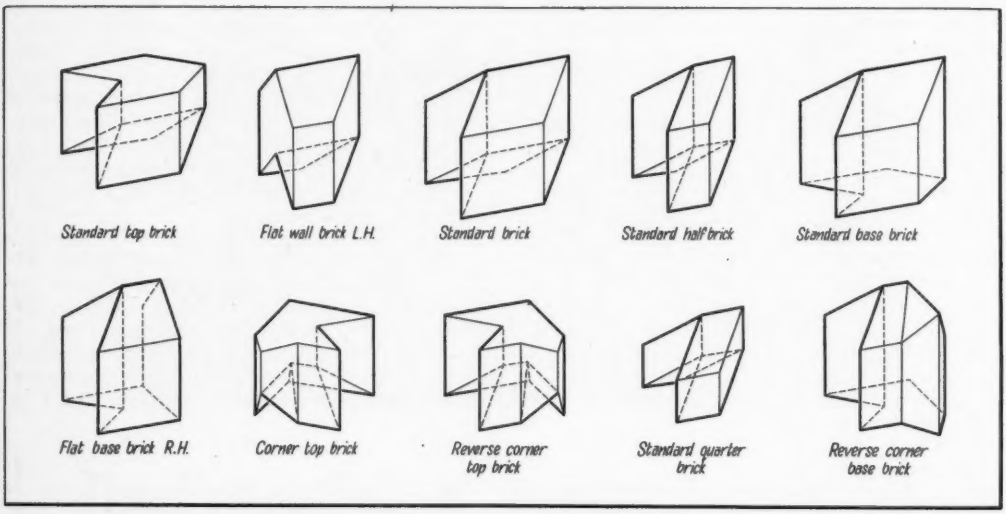


Fig. 2. Typical variants for the 2-in. and 4-in. chevron lead brick systems, which are based on interlocking vee profiles. Each system requires a total of 19 variants

brick described, there is a considerable number of variants, some examples of which are shown in Fig. 2. These variants include flat top and flat base bricks; corner bricks; flat top and flat base corner bricks; reverse corner bricks (standard, flat top and flat base); and half and quarter bricks. Since many of these items are unsymmetrical, they must also be "handed," and the 2-in. and 4-in. systems, each requires a total of 19 variants.

Typical limits on units for these two systems are +0 min., −15 min., on the 90-deg. mating angles, +0·03 in., −0·00 in. across the parallel side-faces and on length, and ±0·01 in. on depth. Although a clean surface, free from irregularities, such as could be produced by casting the components in smooth metal moulds, is acceptable to the U.K.A.E.A., it is the firm's policy to machine the

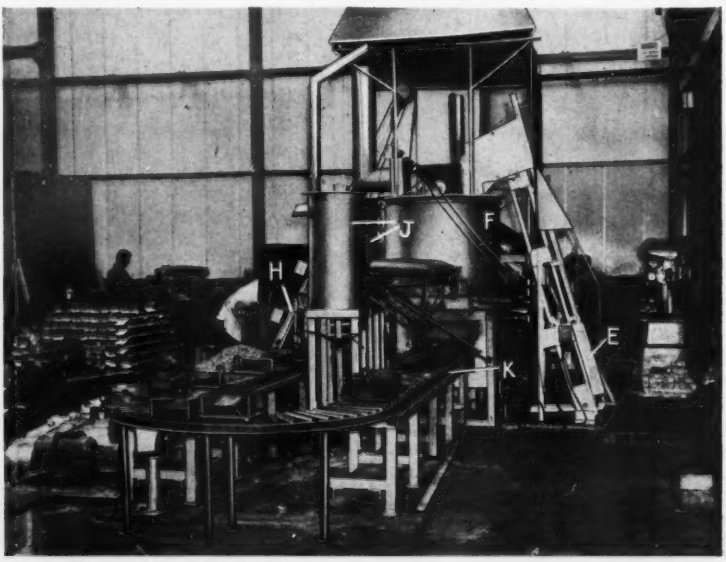


Fig. 3. In this view of the lead casting plant may be seen the conveyor, the main melting furnace, the two holding furnaces, and the two power elevators

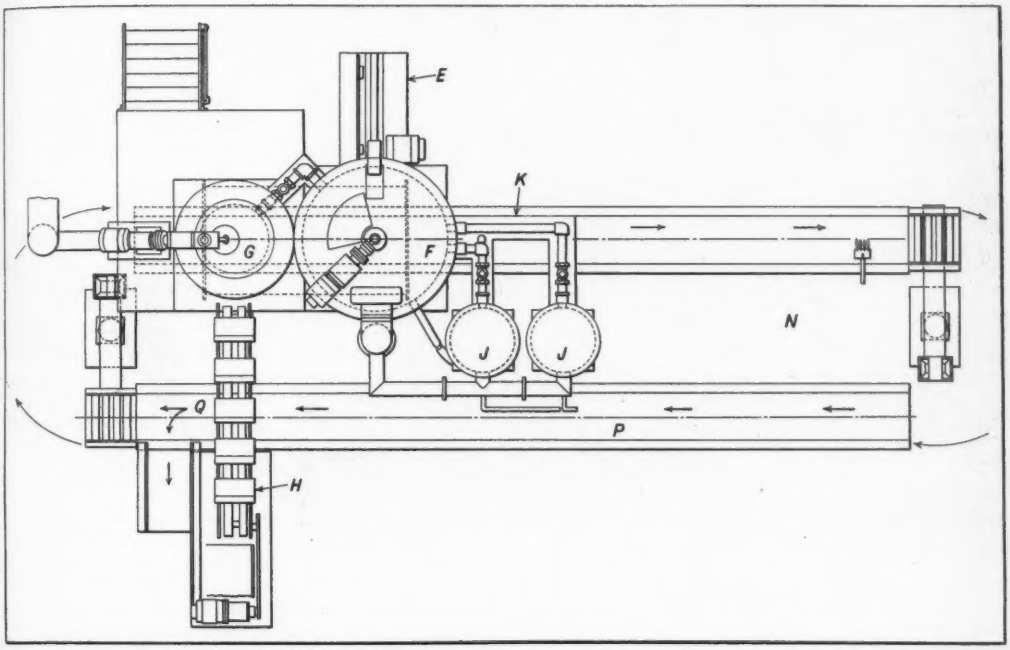


Fig. 4. Schematic plan-view of the lead casting plant, showing the arrangement of the principal items. The main melting furnace *F* has a capacity of 3 tons

surfaces of the cast bricks, wherever practical, in the interests of good finish, and accuracy. Corner bricks are typical exceptions, since the intersections of the internal vees render machining impractical, and these and similar items are lightly dressed by hand methods. To obviate risk of accidental damage to the various sharp edges, during handling, these edges are removed, to leave narrow flats with a width of $\frac{1}{16}$ in. Internal corners have a radius of $\frac{1}{32}$ in.

LEAD CASTING PLANT

To facilitate the casting of lead bricks, the company has designed and built the plant shown in Fig. 3, a schematic plan-view layout of which is given in Fig. 4. Ingots of 4 per cent antimonial lead are raised, by means of the power elevator *E*, to the main melting furnace *F*, which is of 3 tons capacity. In addition, the main furnace is fed from the 750-lb. swarf furnace *G*, which is served by another power elevator *H*. The swarf, from a nearby machining section, to which reference will be made later, is dumped at the foot of the elevator, in readiness for re-melting. From the main furnace, the molten metal is fed to two holding furnaces, *J*, each of which has a capacity of 700 lb. All four furnaces are gas fired, and the two holding furnaces serve the pouring station at *K* (Fig. 3), a view of which is given in Fig. 5.

As may be observed in Fig. 3, 4 and 5, a return-circuit roller conveyor is provided, to facilitate handling the moulds. Empty moulds are withdrawn, along the conveyor, from a preheating furnace situated beneath the swarf and main furnaces, to the pouring station. In Fig. 5, two typical chevron brick moulds are seen in position, in readiness for pouring, and it may be noted that a simple weld-fabricated construction is employed, in which extensive use is made of standard rolled steel angle.

The parting faces of the moulds are arranged at diagonally opposite corners, which are provided with welded-on lugs, and each pair of mould halves is held together, and mutually located, by pins inserted through holes in the lugs. Clamps are applied to the other two corners, to secure each "assembly" to a baseplate that closes the bottom of the mould. The required amount of

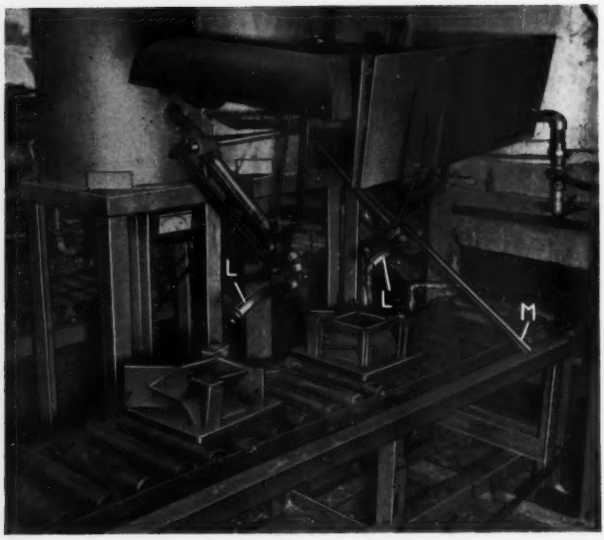


Fig. 5. Close-up view of the pouring station of the lead casting plant, with two preheated moulds in position beneath the tap-off pipes *L*, ready for pouring

metal to fill each mould is tapped off from the holding furnaces through either of the pipes *L*, by operating an associated stop-cock through the hand-lever *M*.

It is essential for the castings to be free from blowholes and porosity, and to ensure that they are sound, the metal is "puddled" by probing it with an iron rod, until it begins to solidify. Puddling is carried out by an operator stationed in the area *N*, Fig. 4, who is also responsible for moving the poured moulds along the conveyor, and is facilitated by "flashing" the surface of the metal, with an oxy-acetylene fish-tail burner, to keep it molten.

Once the main mass of the metal has begun to solidify, the mould is moved on to a power-driven cooling section *P*, Fig. 4, of the conveyor, which carries it to the stripping station *Q*. This section of the conveyor, it may be noted, is driven by a ½-h.p. geared motor, through the headstock gearbox unit of an obsolete lathe, which affords a range of speeds from 3 to 12 in. per min. At the stripping station, another operator strips the moulds, re-assembles them, and returns them to the preheating furnace, and the castings are stacked in a storage area nearby, whence they are drawn, as required, for machining. The same operator is also responsible for loading swarf on to the elevator that serves the swarf furnace. With the equipment described, moulds for 2-in. chevron bricks can be poured at the rate of 40 an hour. The output of larger bricks is proportionately lower, because of the longer time which is required for the pouring operation, also for the subsequent cooling and solidification stages.

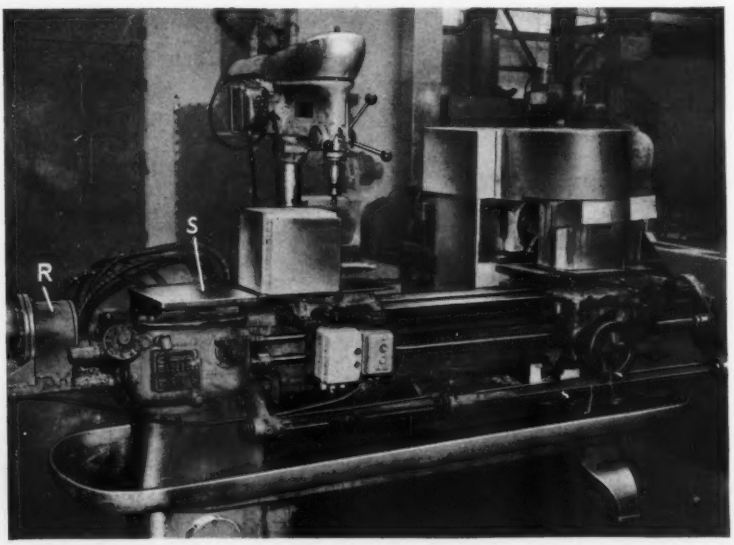


Fig. 6. This obsolete lathe has been adapted to facilitate the machining and handling of some of the large lead bricks, which are of considerable weight

Fig. 7. For machining 2-in. and 4-in. chevron bricks, the company has designed the hydraulically-operated special-purpose 3-station milling machine here shown

MACHINING LEAD BRICKS

The majority of the larger bricks, for the 7-in., 9-in. and 10-in. systems, are profile-milled on horizontal machines, with long, correspondingly - profiled cutters of the roller-mill type. These cutters are usually of case-hardened mild steel, and are produced in the company's toolroom. A proportion of the bricks for these systems is machined flat on two adjacent faces, and since each brick is of considerable weight, a tapped hole is provided in one face, for the insertion of a lifting eye, to assist handling. To facilitate machining the faces, and drilling and counterboring the holes for the lifting eyes, an obsolete lathe, adapted as shown in Fig. 6, is employed. This lathe, it may be noted, provided the headstock gearbox unit for the power conveyor of the lead casting plant.

In addition to the removal of the headstock, the machine was modified by the installation of a ½-h.p. electric motor, with an Oppermann 100:1 reduction gear, at the left-hand end, as seen at *R*, Fig. 6. This unit, which has an output speed of 14 r.p.m., is coupled to the original feed gearbox, to enable a range of saddle feed-rates to be selected. The saddle is equipped with a flat table, which is arranged at the same height as that of a bench drill mounted on the ways towards the left-hand end, as seen. In the position originally occupied by the headstock, there is another table *S*, which is effectively continuous with that of the drill, and at the rear, towards the right-hand end, there is a special two-spindle head, with one horizontal and one vertical spindle. These spindles are driven at 750 r.p.m., by a 2-h.p. electric motor, to which the horizontal spindle is coupled directly. The vertical spindle is driven from the horizontal spindle through bevel gears.

The various tables are all arranged at one level to facilitate handling, and the procedure is typically as follows. With the saddle table traversed clear of the two-spindle head described, a brick is lowered on to the table with the aid of an electric hoist, and is located against stops. Power feed is then engaged, and two faces of the work are machined simultaneously with two fly cutters, set-up on the spindles of the head. At the end of the pass, the saddle is traversed to the left, manually, by means of the rapid-traverse hand-wheel, until the saddle table abuts against the drill table. The operator slides the brick off the saddle table on to the drill table, where he drills and counterbores the hole for the lifting eye, and he then slides it on to the table *S*. Here, the hole is tapped by hand, a ¾-in. Whitworth Helicoil thread-insert (Armstrong Patents Co., Ltd.) is assembled with the aid of a special tool, a lifting eye is inserted, and the work is removed with the electric hoist. Meanwhile, during these operations, another brick is loaded on to the saddle table, and machined with the two-spindle head.

SPECIAL-PURPOSE 3-STATION MACHINE

The company has also designed and built the special-purpose 3-station machine shown in Fig. 7, which is installed in the machining area adjacent to the lead casting plant, and is employed for machining chevron bricks for the 2-in. and 4-in. systems. This machine has a weld-fabricated

Fig. 8. In this close-up view of one of the stations on the special milling machine, may be seen details of the profiled vice-jaws, which are hydraulically operated

table of 72 in. by 44 in., comprising a frame of 12-in. channel-section, with a tee-slotted top plate of 2-in. mild steel, on which are mounted three hydraulically-operated vices of the form shown in Fig. 8. The table, it may be noted, was originally designed for another machine, for trepan boring graphite blocks. In the application here considered, it is arranged for hydraulic feed, by means of a single-acting ram, and hydraulic pressure, at 200 lb. per sq. in., is provided by a gear-type pump driven by a 1-h.p. electric motor.

The forward stroke of the ram provides the cutting feed, and during this stage, the movement of the table raises a weight through a cable and pulley system, part of which may be seen at *T*, Fig. 7. When the cutting pass has been completed, this system serves to return the table to the loading position (Fig. 7). At the same time, oil is exhausted from the cylinder, in readiness for the next cutting pass. A metering orifice in the hydraulic circuit ensures that the table returns at a controlled rate. The table moves on ball-bearing rollers which are supported on ways mounted on the fabricated base-structure *U*. On one side of the table, the rollers are inclined, in opposite directions alternately, to engage and locate on a 3-in. diameter steel rod that comprises the corresponding way. On the opposite side, the rollers are arranged horizontally, and travel along a conventional flat-type slideway.

As may also be observed in Fig. 7, the table is spanned by a robust bridge structure, that serves to carry three multi-spindle cutter-heads of the design shown in Fig. 9. On each of these heads, the central spindle mounts a fly cutter incorporating two high-speed steel tools, whereas the spindles on either side are provided with profile cutters, as shown. This arrangement of cutters provides for machining three faces of the work simultaneously at each pass, namely, one flat face (fly cutter); one internal vee (cutter seen at the right); and one external vee (cutter seen at the left). The ratios of the gears that couple the three spindles together are such that the fly cutter runs at 750 r.p.m., and the two profile cutters at 1,000 r.p.m. The 6-bladed cutter for machining the internal vees is of case-hardened solid mild steel, whereas that for the external vees comprises two conical bodies, each incorporating eight brazed inserts of high speed steel. These inserts, it may be noted, are produced from discarded power hacksaw blades.

Each of the heads is mounted on the bridge structure of the machine, by means of a spigot, as seen at *V* in Fig. 9. This spigot engages a corresponding bore in the bridge structure, in which it is clamped. In setting-up, the effective working distance between the two profile cutters, and consequently the dimension between the apices of the vees on the machined component, can readily be adjusted by rotating the spigot in the bore, to alter the angular relationship of the head to the feed-axis of the work. In the same way, both 2-in. and 4-in. bricks can be accommodated. This method of mounting also enables the head to be used on other machines. On the 3-station machine, a 10-h.p. Brook motor is mounted vertically on the bridge structure, as seen at *W*, Fig. 7. The motor-shaft is provided with a 6-groove pulley, whereby each head is driven through a separate pair of vee belts, and a 2-groove pulley on a shaft, as seen at *X* in Fig. 9, which runs in taper roller bearings.

Referring again to Fig. 8, in which two of the heads are seen set-up, with the guards in position, it will be observed that the hydraulically-operated vice at each station is provided with profiled jaws. The flat upper face, and the two vee side-profiles of the jaws, are designed to afford the necessary

cutter-clearances, and the engaging faces serve to locate the work by the internal and external vees. All three vices are actuated simultaneously, by means of a hydraulic hand-pump Y, Fig. 7, and an associated selector-valve which provides for reversing the direction.

The machine is normally tended by two operators, one of whom loads one vice and operates the hand-pump, whereas the other loads the two remaining vices, and controls the cycle. When all three vices have been loaded, the work is fed between the revolving cutters at 6 in. per min., and during this stage, as already explained, each component is machined on three faces. At the end of the pass, the table is returned to the loading position, and the component at each station is inverted, and turned through 90 deg., so that the internal and external vees previously machined are located by the corresponding profiles of the vice-jaws. Thereupon, the working pass is repeated, so that each component is machined flat on the second side-face, and to the required vee profile at each end. Finally, the table is again returned to the loading position, and three fully-machined bricks are unloaded. The floor-to-floor time for three bricks is 16 min., and some 90 bricks are machined per 8-hour shift. Soluble oil coolant is fed sparingly to the cutters.

FINISHING AND INSPECTION

After they have been machined, the bricks are transferred to another department, where they are hand finished, as mentioned earlier, and subsequently radiologically inspected for porosity.

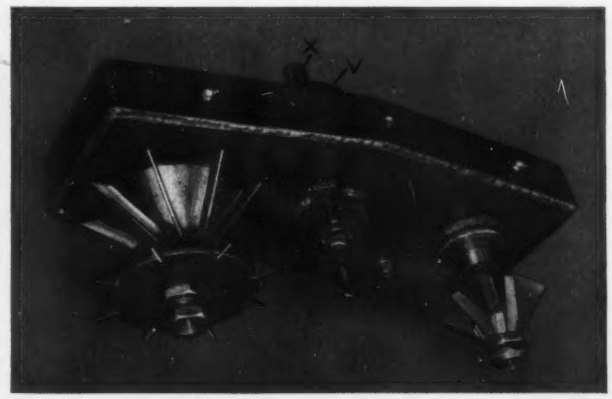


Fig. 9. One of the 3-spindle heads, removed from the machine, to show details of the cutter arrangement. The cutter at the right is of case-hardened mild steel

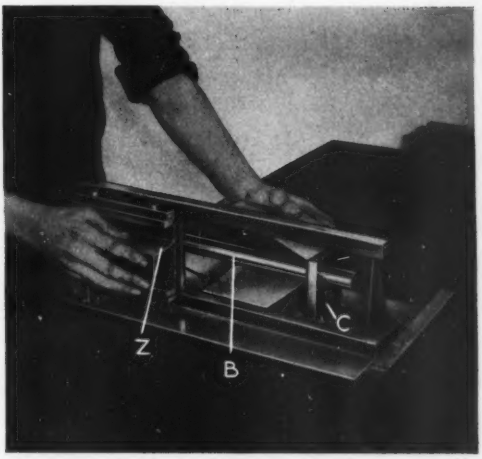


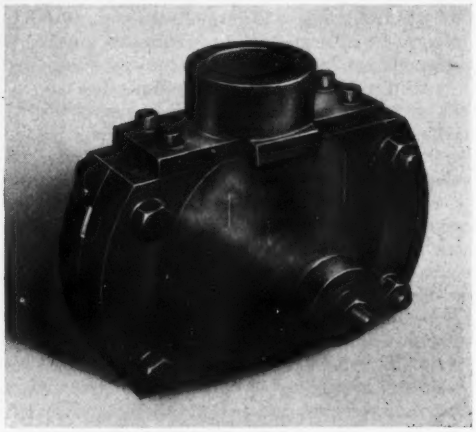
Fig. 10. Simple fixtures, of the design here shown, are employed for shaving-off the sharp edges of the chevron bricks, to leave narrow flats of controlled width

Here, also, they are checked dimensionally, in receiver-type fixtures supplied by the U.K.A.E.A. To facilitate the removal of the sharp edges on either side of the internal vees, to leave the $\frac{1}{16}$-in. flats, simple fixtures of the design shown in Fig. 10 are employed. The sliding member Z has a blade *A* mounted on the forward edge, and, initially, is withdrawn to the extreme rearward position, as seen. A brick is laid on one of the flat sides, on the flat base of the fixture, and is thrust, simultaneously, against the locating bar *B*, and the endstop *C*. A few rapid strokes of the member *Z* then serve to shave off the edges in question, and the locating bar *B* ensures that the depth of cut is accurately controlled.

Radiological checking, for porosity, is carried out as shown in Fig. 11. A number of bricks is built-up, as seen at the right, to form a small section of barrier of a convenient size, and this section is then "explored" by scanning it with a gamma-ray source and a Geiger-counter head. For this purpose, the units are mounted on a light framework of metal rods, so that the source and counter head are maintained in the required relationship, on opposite sides of the barrier. The counter head is connected to the elec-

tronic unit *D*, which is provided with a dial-type indicating instrument, and a small loudspeaker. Depending on which of these instruments is selected, the presence of any porosity in the barrier is indicated by movement of the dial-instrument pointer, or a signal from the loudspeaker. For the 2-in. and 4-in. systems, a 0·29 millicurie source is employed, and for the 7-in., 9-in., and 10-in. systems, a 0·5 millicurie source. Any porosity thus detected is rectified by re-melting the surface, in the immediate vicinity, with an oxy-acetylene torch.

In addition to the lead bricks, the company produces a number of other radiation-barrier components, among which may be mentioned lead window assemblies, with steel liners to accommodate the thick lead-glass transparencies, and spherical ball-joints, also of lead, for various types of handling tongs. A typical 7-in. ball-joint is shown in section in Fig. 13, and a feature of the design is that provision is made for air flotation, to ensure that the sphere can move freely. To avoid surface-scuffing and seizure, the sphere is coated with Monel, which is highly polished. Since the sphere is of considerable weight, moreover, and is likely to damage the lead outer bearing by "Brinelling" when the air-flotation system is de-energized, a recessed stainless steel pad *E* is cast into the bottom portion. Compressed air, for floating the sphere, is introduced into



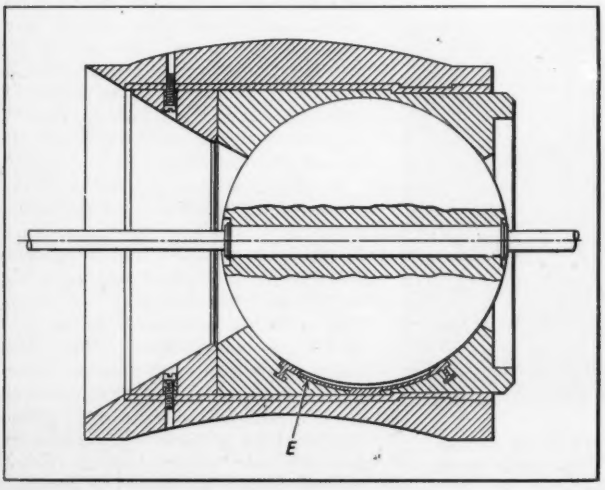


Fig. 11. (above) Checking finished chevron bricks for porosity, by means of a Geiger counter head and a gamma-ray source supported on a framework of metal rods

Fig. 12. (right) Graphite mould for casting lead spheres for ball-joints of the design seen in Fig. 13. This material is readily machined, and parts cleanly from the metal

Fig. 13. (below) Sectional view of a typical 7-in. lead ball-joint assembly, for handling-tongs. The sphere is supported by air-flotation

the recess. These joints, it may be noted, are produced by the company under licence from the U.K.A.E.A.

Lead spheres for these joints are cast in graphite moulds of the design shown in Fig. 12. The body of the mould comprises two halves, located in relation to each other by annular registers on the joint faces of the bolt-flanges, and surmounted by a split header secured by screws. On each half mould, there is an external boss, and these bosses are drilled to receive a steel bolt, which is inserted through them before the mould is poured. In addition to serving as a tie-rod, to reinforce the mould against the pressure of the casting-metal, this bolt locates a liner of mild steel tube in the mould cavity, which is cast diametrally into the sphere. Graphite is employed for the moulds, in preference to metal, because it affords several advantages. It parts readily from the casting-metal, without damage, and gives a good surface-finish. Such moulds are also easier to handle than corresponding metal moulds, as they are appreciably lighter. Some care is necessary in handling, however, on account of the brittleness of the material. With the facilities and experienced operators available at the factory, graphite moulds are considerably easier to machine than those of metal.

Fig. 14. Coating a 7-in. lead sphere with Monel by flame spraying. The work is rotated at 4 r.p.m. by means of a portable drill and a reduction-gear unit. Drive is transmitted through short lengths of flexible rubber hose

Fig. 15. Finish turning a Monel-coated sphere on a centre-lathe at 90 r.p.m. A rotary table, mounted on the cross-slide, serves as a spherical turning attachment, and the sphere is held on a mandrel, between centres

FLAME SPRAYING

Typically, 7-in. spheres are cast to 6·855 in./6·865 in. diameter, and after the removal of the headers, and light fettling, they are flame-sprayed with Monel, to approximately 7⅛ in. diameter. For this purpose, the equipment shown in Fig. 14 is employed. The sphere to be sprayed is placed over a vertical spindle, on which there is a collar that supports it at the required height, by the cast-in tubular liner. This spindle is driven at 4 r.p.m. by a portable electric drill, as seen, through a flexibly-jointed shaft, a worm reduction gear, and a friction clutch. Since only light loads are involved, the flexible joints for the shaft are made from short lengths of rubber hose, secured with Jubilee clips.

A Metco type 4E gun (Metallizing Equipment Co., Ltd.) is employed, and the ⅛-in. diameter wire is drawn from a coil on a horizontal turntable. The coating is applied in layers of approximately 0·010 in. at a time, at a spraying rate of 12·8 lb. per hour, and after each such layer has

been applied, it is necessary to allow the work to cool for about 15 min. If spraying is carried out continuously, there is a risk of melting the lead. To avoid loss of time while the work is cooling after the application of each layer, it is usual to work on a batch of about six spheres at a time. These spheres are sprayed in sequence, until a total coating thickness of approximately ⅛ in. has been built-up on each.

For machining the spheres to finished size, they are set-up on a mandrel, between centres, on a lathe, as shown in Fig. 15, and a rotary table, equipped with a toolpost, which is mounted on the cross-slide, serves as a spherical turning attachment. The work is run at 90 r.p.m., and light skimming cuts are taken with the carbide-tipped tool, by rotating the table by means of the handwheel. Once the work has been brought to the required size, it is polished with fine emery-cloth. Lead spheres, for similar applications, are produced by the company in a variety of sizes, and the smaller spheres are initially machined on a Dubied (Wickman, Ltd.) profile copying lathe. After the application of the anti-scuffing layer of dissimilar metal, they are centreless ground.

Some further examples of the firm's work in the nuclear field, concerned with the machining of graphite, will be discussed in a later article.

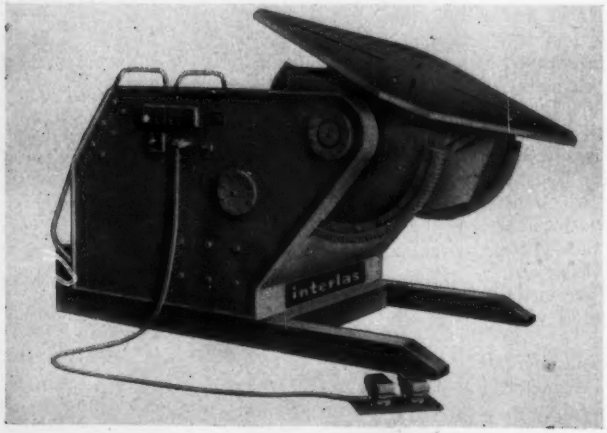
Interlas Welding Positioners

Interlas, Ltd., 9 Church Street, Ampthill, Bedford, have introduced a range of welding positioners made by the German firm Tehag. There are ten sizes, with maximum load capacities from 33 lb. to 10 tons. The smallest unit, known as the type DB15, is arranged for bench mounting. It has a steplessly-variable speed range from 0·3 to 3 r.p.m. and a foot-operated remote control for starting and stopping leaves both the operator's hands free for welding.

The slotted work plate, of 12 in. diameter, incorporates a built-in earthing attachment, and can be tilted through 360 deg. and locked in any position. A switch for forward and reverse motion is provided on the front of the body.

The largest positioner, designated type DB 10,000, which has a capacity of 10 tons, is shown in the accompanying figure. It has a speed range of 0·06 to 1·2 r.p.m., and the 5-ft. square table, which has a 750-amp. earthing attachment, can be tilted at 0·5 r.p.m. by twin, heavy-duty gear segments. Foot-operated remote controls can be supplied for starting and stopping the rotary and tilting motions. Alternatively, push-button remote controls can be provided for "forward," "stop," "reverse" and "fast-slow," for rotation, and "up" and "down" for tilting.

Complete equipments for the automatic welding of small cylinders are also available, each of which comprises a rotating fixture, supports for the welding head, and electronic controls.



Interlas type DB 10,000 welding positioner of 10 tons capacity

NEW LOW-HYDROGEN ELECTRODE. A new electrode, known as EutecTrode 66, has been developed by Eutectic Welding Alloys, Ltd., North Feltham Trading Estate, Feltham, Middx., and is stated to be particularly suitable for joining low and medium-carbon steels, crack-sensitive and free-cutting steels, and "difficult" steels, such as those with high sulphur or phosphorus contents. As a result of its high ductility, and good resilience at low temperatures, this type of electrode can be employed for welding large rigid structures which are highly stressed.

An important feature of this electrode is its high and fast rate of metal deposition, and it can be employed for filling fairly wide gaps, also for plug and slot welding. It can also be employed for overlaying components such as worn shafts and gear teeth, to restore them to the required shape and size, and is suitable for use with malleable cast iron.

Bryant Type B Centalign Internal Grinding Machine

THE TYPE B CENTALIGN internal grinding machine shown in Fig. 1 has been introduced by the Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A., for various operations on miniature and instrument bearing races, and is available in two versions, for bores and ball tracks. The machine has a capacity for work up to 0·625 in. outside diameter, by 0·406 in. wide, and enables ball tracks and bores to be ground up to 0·5 and 0·3125 in., respectively. At the opposite end of the capacity range, ball tracks and bores can be ground in parts with minimum outside diameters of 0·1 and 0·0437 in. The total wheel-slide stroke on the standard machine is 3 in., and the maximum grinding stroke, 0·25 in. For automatic operation, the maximum cross-feed which can be applied to the wheel-head is 0·040 in., on diameter, and under manual control, 0·25 in.

A feature of the machine is the provision of packaged tooling, as shown in the partially "exploded" view in Fig. 2. This unit can be removed from the machine for re-setting or adjustment, or when a change is to be made to another size or type of component. If two such units are provided, setting can be carried out on one while the second is in use on the machine, so that a change-over can be made with the minimum of interference with production. A steel base-plate, secured to the machine table by a single quick-acting clamping screw *A*, supports the mechanism, which is designed to feed parts to the grinding position, rotate them during grinding, and eject them at the end of the cycle, entirely automatically.

Components placed manually in the magazine *B*, are pressed downwards by a weight on the upper end of a plunger, since they are often too light for effective self-feeding. At the bottom of the magazine, the parts are fed sideways by a loading blade *C*, which is advanced by the small hydraulic cylinder *D*, into contact with a stationary carbide shoe *E*, whereby it is located horizontally. Vertical location is provided by the lower of two driving discs, and the upper disc, mounted on an adjustable arm, imposes a light downward thrust sufficient to hold the part in position without distortion, and ensure the necessary friction for driving. The discs are both skewed horizontally, so that axial force is exerted on the work to hold it against a carbide ring. Axial location is thus obtained, and it is ensured that the plane of the work face is accurately at right-angles to the axis of the bore. After grinding has been completed, the next part is advanced and pushes the previously-finished piece out of position, down the chute *F*.

The machine is equipped with the special wheel-head shown in the cut-away view in Fig. 3, which incorporates a high-frequency spindle, supplied by a frequency-changing unit. Spindles with ranges from 60,000 to 100,000, and 100,000 to 150,000 r.p.m. are available, to suit the diameters to be ground, and the dynamically-balanced armatures are carried in high-precision pre-loaded ball bearings.

The wheel motor housing seen at *G* is mounted in a pre-loaded ball sleeve, and can be moved axially

Fig. 1. The Bryant type B Centalign internal grinding machine is intended for grinding ball tracks or plain bores in components for miniature and instrument bearing races

for bore-grinding operations. This motion is imparted by a cam and lever arrangement on the wheel-slide housing *H*, and there is a single adjusting screw whereby the length of the grinding stroke can be set to any amount from 0 to ¼ in., longer strokes being obtainable by the use of a special cam. The speed of reciprocation is steplessly variable by means of a rheostat which controls the d.c. driving motor.

Near the wheel end, the sleeve in which the housing moves is provided with trunnions as at *K*, which are carried in pre-loaded ball bearings, and it is guided at the other end by pre-loaded ball bearing ways at *L*. Cross-feed motion to the wheel is imparted by a screw, the axis of which is aligned with those of the trunnion bearings. With the axes of the traverse and feed motions thus arranged to coincide with, or pass through, the centre-line of the wheel spindle, very accurate control of the wheel path is obtained. During grinding, the cross-feed screw is turned by a d.c. motor, controlled by rheostats which can be set to provide a fast and a slow feed rate for rough and finish grinding, and near the end of the cycle an electric timer is brought into operation to control the duration of the spark-out period. In addition, a quick-approach mechanism is incorporated, to bring the wheel rapidly to and from the grinding position, to reduce the cycle time.

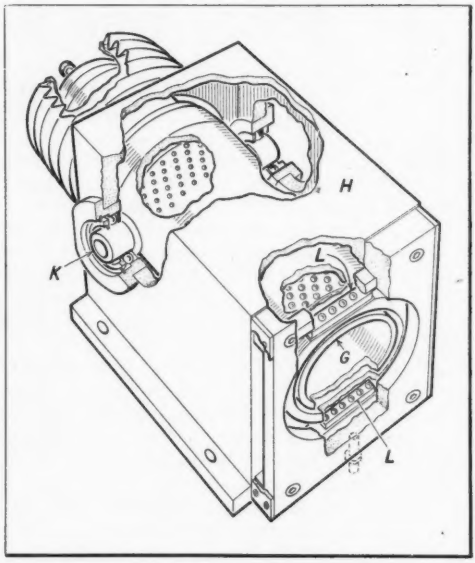


Fig. 3. Cut-away view of the Bryant Centalign grinding head, which is so arranged that the axes of the traverse and feed motions coincide with or pass through the wheel-spindle axis

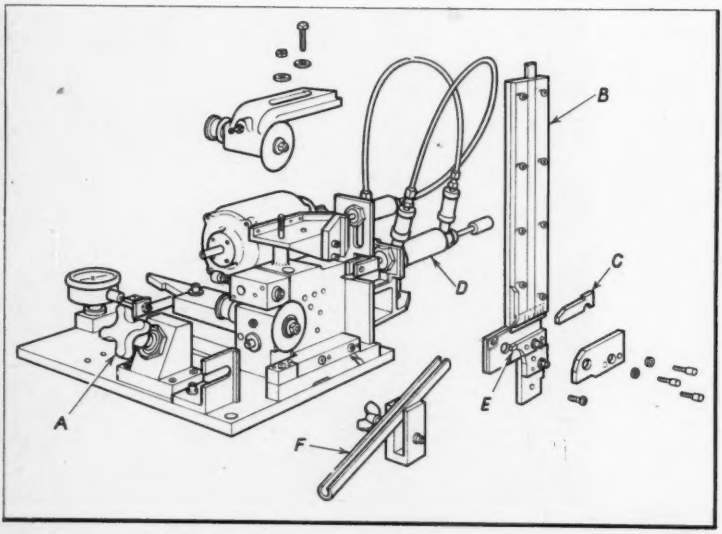


Fig. 2. A partially "exploded" view of the "packaged tooling unit" fitted to the Bryant machine for automatically feeding parts to the working position, rotating them for grinding, and ejecting them

A dressing mechanism for new wheels is provided, which is designed to repeat the dressing operation until the wheel is of the correct size for the workpiece. When the wheel is of the required size the grinding cycle is started automatically, and it is thus ensured that the first piece is ground accurately to size. With the bore-grinding machine, a plug-sizing unit can be employed, the plug being carried in a miniature bearing to permit free rotation when it is in contact with the workpiece. The forward portion of the plug is supported by an air bearing, and with this arrange-

ment the plug can float radially and align itself with the workpiece bore. A light compression spring urges the plug into the bore, and when it enters, the grinding cycle is stopped automatically.

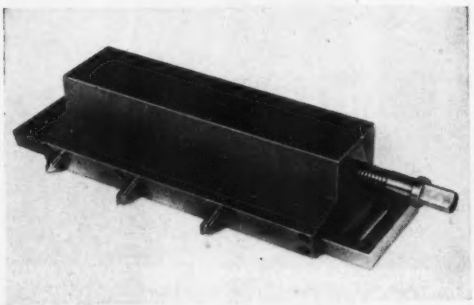
Two different grinding cycles can be selected by means of a switch on the control panel of the machine, and provide for dressing the wheel either before or after finishing. In addition, by the use of a counter unit, dressing may be eliminated from the cycle while any number of parts from 1 to 19 is ground.

Bryant Grinding Machines are handled in this country by Buck & Hickman, Ltd., Otterspool Way, By-Pass, Watford, Herts.

Larrad Planer Hydrajaw Clamping Unit Type PJ I

The Planer Hydrajaw clamping unit shown in the figure has recently been added to the range of hydraulic work-holding equipment made by Larrad (Hydrajaws), Ltd., 61 Queens Road, Coventry. The subject of a patent application, this unit is particularly intended for use on planing machines and heavy-duty milling machines for securing large flat steel plates in preparation for machining operations.

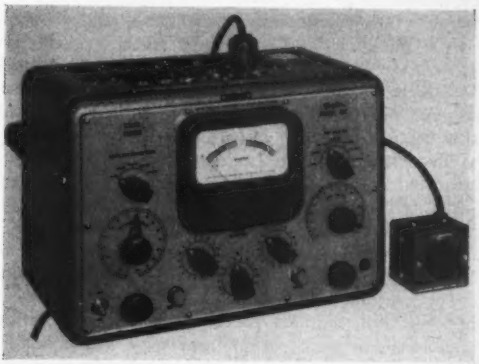
Slots to take fixing bolts are provided in the base, and enable the unit to be adjusted through a distance of 3 in. towards and away from the work to be clamped. Rotation of the operating screw in one direction causes three "spiking down" plungers in the base to be advanced hydraulically into engagement with the work, which is clamped with a maximum force of 7,000 lb. Because these plungers are inclined at an angle of 15 deg. the clamping force is applied downwards as well as horizontally, for holding the workpiece firmly on the surface of the table on the machine. When the screw is turned in the opposite direction, the plungers are retracted to facilitate releasing the workpiece.



Larrad Planer Hydrajaw hydraulic clamping unit for securing large flat workpieces

"Electrical Instruments" Valve Testing Equipment

A new valve tester, known as the type 45C and shown in the figure, has recently been introduced by Taylor Electrical Instruments, Ltd., Montrose Avenue, Slough, Bucks. It will test more than 5,000 different types of valves, of British, American, and Continental origin, including the latest 12-volt motor car radios, and the test facilities include checks for element shorts, cathode leakage, and emission. Two ranges of mutual conductance are provided, namely 0 to 3 and 0 to 15 ma/V, and an accurate moving-coil meter enables valves to be matched, or compared, for push-pull circuits.



"Electrical Instruments" valve testing equipment

The unit incorporates 21 valve holders and is supplied complete with an instruction book and a manual of valve characteristics. Test facilities are also provided for earlier types of valves, in addition to those for the latest T.V. circuits. A T.V. tube adaptor is available which incorporates a special base for the latest design of wide-angle 110-deg. tubes, and is seen at the extreme right.

EXPORTS OF MACHINERY, other than electric, to Western Germany during the first nine months of 1960 reached a value of £23,406,210, compared with £16,848,705 in the same period of 1959.

H

The Production of the SIMCA Aronde

Examples of Work-handling in the Light Press Section of the New Works at Poissy, France

By P. A. SIDDERS, Chief Associate Editor

IN A PREVIOUS ARTICLE in this series* devoted to the manufacture of the Aronde car at the new SIMCA works at Poissy, France, reference was made to the large new press shop, and to some of the machines and equipment for the production of large components. Brief details were also given of the light press section which occupies an area at one side of this shop, and certain features of this section will now be discussed more fully.

The area occupied by the light press section is subdivided into three long zones, which are separated by broad gangways. These gangways provide for the passage of fork-lift and other trucks, and the whole area is served by overhead travelling cranes, with hoists of 50 and 15 tons, or of 30 and 10 tons. There is a total of 76 presses and similar units—such as Multi-Slide machines—in the section, and they are arranged in rows extending lengthwise, with two rows in each zone. The rows of presses in each zone are back-to-back, and between the two rows in each zone there are pillars which support Canalis bus-ducting for the supply of electrical power to the machines, also compressed air mains.

In the preceding article, mention was made of the standardized work-handling equipment, with particular reference to units for use with the larger presses. The standards system also includes equipment for use with smaller presses, most of which is built by SIMCA, or to the company's design. As for the larger units, each standard sheet for the smaller items of handling equipment incorporates perspective sketches of the unit concerned, with an indication of how it is installed, and full working drawings are available if required.

A typical standard work-handling unit is the discharge shuttle seen in Fig. 1. This unit is fitted to a Grimar type SR1-10 power press, and incorporates a chute *A* which slides between the side members of the support *B*. At the end nearer to the camera, the support is pivotally mounted on the base *C*, which is secured to the press frame. Link-members are fitted to the other end of the support, and the free ends of the links, below the support, are connected by a cross-bar which passes through a sliding block. This block is threaded internally to receive a screw coupled to the crank-handle *D*, and by turning the handle, in one direction or the other, the angle of the support, and of the chute *A*, can be adjusted.

To the under-side of the chute *A* is secured a rack, the teeth of which mesh with a gear mounted on a transverse shaft carried in bearings in the support *B*, one end of this shaft being visible at *E*. A pinion is fitted to the other end of the shaft, and it meshes with a quadrant lever, carried on a pivot pin on the right-hand side of the support. The lever extends on the side of the pivot opposite to the quadrant teeth, and is coupled to the bifurcated end of a connecting rod *F*. This rod is of built-up type, with screw adjustment for

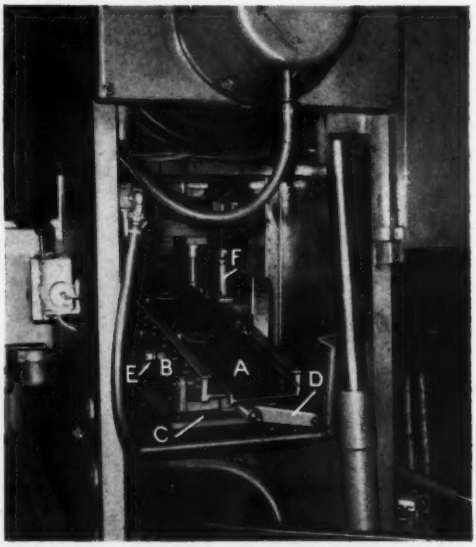


Fig. 1. An automatic unloading chute fitted to a Grimar type SR1-10 power press employed for the production of blanks

* MACHINERY, 95/252–19/8/59; 95/676–7/10/59; 96/748–6/4/60; 96/860–20/4/60; 96/1036–11/5/60; 97/80–13/7/60; 97/1104–16/11/60; 97/1217–30/11/60; and 97/1392–21/12/60.

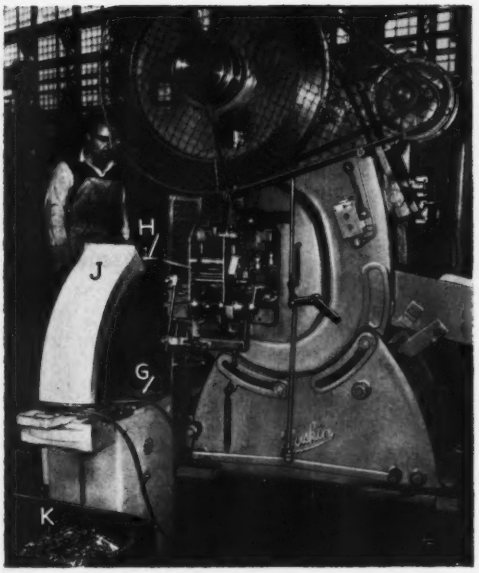


Fig. 2. This independent motor-driven scrap cropping unit is provided for a press operating from coiled material. Waste material, in strip form, is fed into the chute *J*

length, and its upper end is coupled to a bracket secured to the ram of the press.

The tooling of the press is arranged so that the workpiece is carried upwards in the top tool assembly, and the arrangement of the discharge shuttle is such that, as the press ram rises, the chute *A* is moved upwards and inwards until its inner end is below the top tool. When the ram reaches the top of its stroke, the workpiece is ejected, and it falls on to the chute *A*, which is moved downwards and outwards clear of the tool as the ram descends. Movement of the chute during successive cycles causes the workpieces to slide downwards into a container.

POWER-DRIVEN SCRAP-CROPPING UNIT

A discharge shuttle of generally similar type is fitted to the Raskin press seen in Fig. 2. This machine is set up for the production of small rectangular pressings, with two pierced and plunged holes, from coil material, the coil being supported in a cradle on the far side of the press (as here viewed). To facilitate the handling of the waste material, the power-driven cropping unit *G* is provided. This unit is floor mounted, and is specially built for SIMCA by the French firm of R. Delaire, Clichy (Seine).

Waste material, still in strip form, is fed out of the press by the roll feed mechanism, as indicated at *H*, and it passes into the curved, tapered chute *J* of the Delaire unit. The chute is mounted on a part of the base top that extends to one side of the base proper, so that it overhangs a work-pan *K*. This overhanging portion houses a fixed cropping blade, and the other part of the base top incorporates guideways for a slide carrying a moving cropping blade. An electric motor within the base drives a link mechanism which imparts a reciprocating motion to the slide. The waste material is directed by the chute *J* between the fixed and moving cropping blades, and as the material is advanced by the roll feed mechanism, it is cut into short lengths which fall into the work-pan.

MECHANIZED WORK-LOADING EQUIPMENT

Mechanized work-loading equipment is widely employed for presses engaged on secondary operations at the Poissy plant, and includes both proprietary and SIMCA-built units. Among the proprietary types are S.O.C. air-operated swinging arm loaders of various designs, some of which are provided with tongs and suction pads to engage the workpieces.

A typical press set-up using an S.O.C. unit is

Fig. 3. This S.O.C. " mechanical hand " feeding unit is fitted with an electro-magnet to hold the blanks, and transfer them to the tool from a pre-loading position

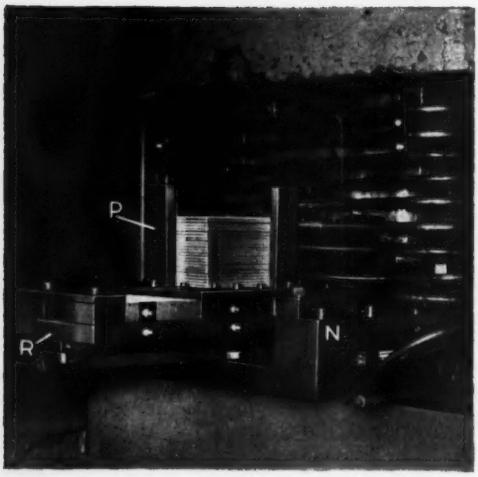


Fig. 4. A SIMCA-built automatic magazine feed unit for loading flat blanks into a second-operation tool, fitted to a Spiertz press

seen in Fig. 3, and in this instance the swinging arm is fitted with an electro-magnet to hold the work. Pressings from the preceding stage in the operation sequence are deposited in the hopper *L*, and the operator removes one pressing at a time from the tray at the bottom of this hopper. She places the pressing in a nest that is supported on a plate which extends outwards from the bottom tool assembly, and is positioned well clear of the tool guard. At each cycle of the press, the arm carrying the electro-magnet *M* is moved downwards, so that the electro-magnet contacts the work. The arm is then raised and swung inwards, lifting the workpiece out of the nest and transferring it to a position over the location members in the tool. Next, the arm is moved downwards, to insert the workpiece between the location members, and the power to the electro-magnet is cut off, so that when the arm is automatically returned, the workpiece is left in the tool.

Workpieces that are fed into press tools in this way are blown clear by an air blast at the end of each operation cycle. They then either fall into a bin, or on to a band conveyor which carries them to the next press in the production sequence. The band conveyors are independent, motor driven, free-standing units, as may be seen at the extreme right in Fig. 3.

A SIMCA-built work-feeding unit is shown in Fig. 4, and is fitted to a Spiertz type 12½ inclinable press. The unit is built on a bolster plate, whereon the pillar-type die-set for the tool is mounted. Blocks at each side of the bolster plate, as indicated at *N*, support a bridge member, of built-up construction, which carries the magazine for the previously-stamped blanks. The magazine comprises a plate with two vertical pillars, as at *P*, that are L-shape in cross-section, and the faces of the pillars engage the sides of the blanks at opposite corners.

Two guide strips are secured to the under-side of the bridge member and are of angular section so that together they form a dovetail guideway, wherein moves the block *R*. This block is connected to a feed slide which moves in a channel in the bridge member and passes beneath the stack of blanks in the magazine. The block *R* is coupled to a rod which passes beneath the tool and through the press frame to the rear, and the end of this rod is seen at S in Fig. 5. It is linked by a screw connection, which provides for adjustment, to a crank *T* on a transverse shaft, carried in bearing brackets screwed to the sides of the press frame. A crank, keyed to the end of the shaft, is coupled to one arm of a bell-crank, that can pivot on a pin fitted to the nearer bearing bracket. The other arm of the bell-crank is linked by the connecting rod *U* to an eccentric assembly, mounted on the end of the press crankshaft, within the cover *V*. As may be seen, the connecting rod *U* is of built-up type, and its central portion takes

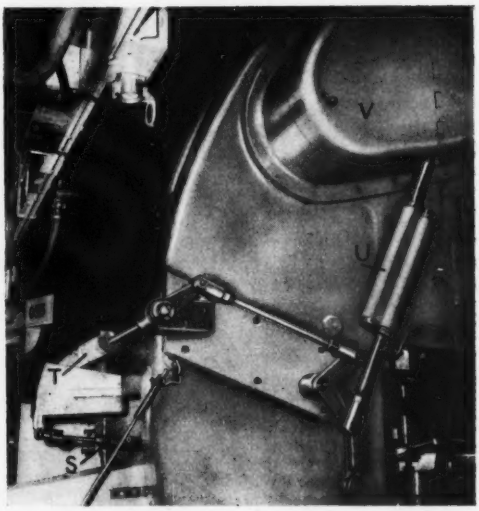


Fig. 5. The mechanical linkage for operating the magazine feed unit (Fig. 4) is driven from an eccentric mounted on the press crankshaft

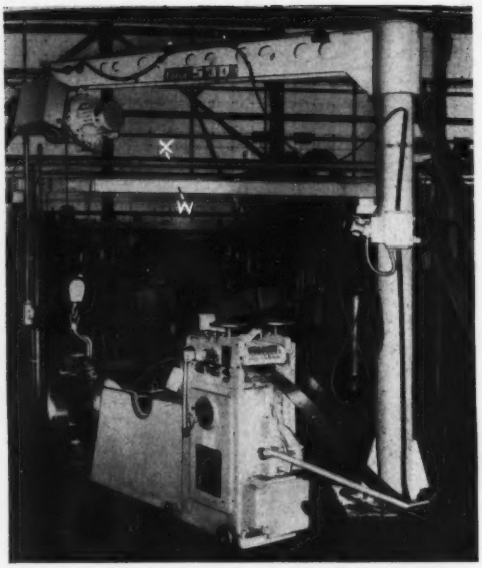


Fig. 6. One of the SIMCA-built jib cranes installed to facilitate the handling of coils of work material

the form of two lengths of tube, welded together. One tube is solidly connected to the portion of the shaft that is linked to the eccentric assembly, and the other tube is free to slide on the portion of the shaft that is coupled to the bell crank. The arrangement is such that there is a certain amount of "lost motion", and movement is only imparted to the bell crank during part of each revolution of the press crankshaft. In consequence, as the press ram descends, the feeding slide is moved away from the working zone of the press tool to receive a blank from the magazine, and is then returned, as the ram rises, to carry the blank into the tool.

JIB CRANE FOR HANDLING COIL STOCK

Reference has already been made to the overhead cranes that serve the small press section, and these units are supplemented by numbers of jib cranes located adjacent to those units that operate on coiled material. A typical jib crane is seen in Fig. 6, and it is employed for loading work material into the coil cradle associated with a Weingarten roller leveller. The structure of the crane is built up from steel plate and sections by welding, and the arm is pivotally mounted on the top of a cylindrical steel column. An electric hoist, with a maximum lifting capacity of approximately 10 cwt., can travel between the side-members of the arm.

The hoist is controlled from a pendant push-button unit. Cable for the supply of power to the hoist is supported by rings, which are attached to it at intervals along its length and are free to slide along a thin rod at one side of the arm. The cable is connected to a switch and fuse box on the column, which is also fitted with a heavy-duty plug for the supply of power to the roller leveller. At *W* and *X*, respectively, in the illustration may be seen the Canalis bus-ducting and the air supply main to which reference has already been made.

MAKING CAPTIVE NUTS ON A U.S. MULTI-SLIDE MACHINE

Captive nuts, as seen at the left in Fig. 7, are made at a rate of 5,000 per hour on a U.S. Multi-Slide machine. Steel strip is fed from a coil, through a roller leveller, and into one end of the machine, and is subjected to successive cropping and forming operations to produce a partly-finished workpiece, that is connected to its neighbour by a narrow tie of metal. At this stage, the workpiece consists of a flat plate with an extension at one side that has been bent up to form a rectangular box-type nest. There is a similar extension at the other side of the strip, which, at this stage, is still flat.

Square nuts, as seen at the right in Fig. 7, are fed to the Multi-Slide machine from a rotary-bowl

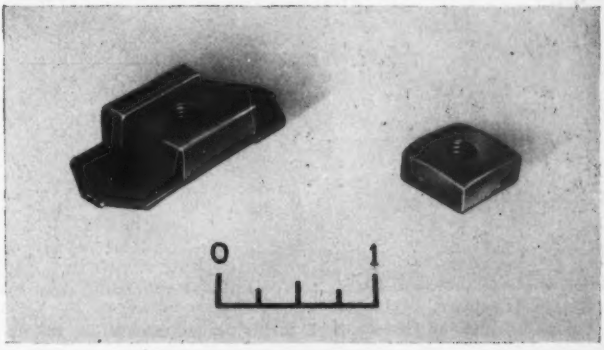


Fig. 7. A captive nut (left) and an insert which is assembled with the pressed up retainer on a Multi-Slide machine

feed unit, which may be seen at *Y* in Fig. 8. By way of a chute, the nuts are delivered to the tool sub-assembly at the last stage but two of the machine, and each nut is inserted in the bent-up nest of the workpiece at that station. At the next tool stage, the flat extension is formed into a second nest to enclose the nut and retain it in position. Finally, at the last station of the machine, the narrow tie between adjacent workpieces is cropped through, and the finished captive nut is blown by an air blast through a curved tube and into a work-pan at the rear of the machine.

Nuts delivered for assembly on the machine still have burrs on them, and the company has installed a deburring barrel alongside the machine at the inlet end. This unit is seen in Fig. 9, and it comprises a built-up perforated metal barrel, which is mounted on the spindle of a small motor-driven adjustable coil stand. The latter has a pillar for floor mounting, and the head is arranged so that the barrel is inclined at an angle of about 10 deg. A sheet-metal chute is arranged below the barrel to catch the small particles of swarf that result from the deburring operation and the machine minder unloads and replenishes the barrel at intervals.

Fig. 9. This deburring barrel for the treatment of captive nut inserts has been fitted to a standard inclinable coil feed unit, and is installed at one end of the Multi-Slide machine

Further articles concerned with assembly operations on the SIMCA Aronde car at the new Poissy plant will be published shortly in MACHINERY.

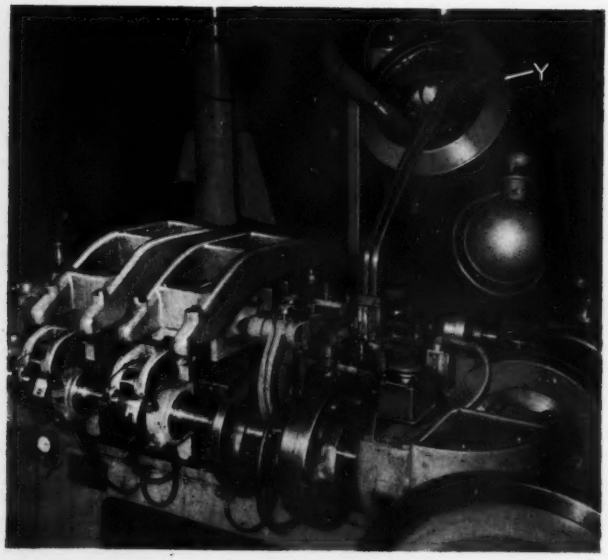


Fig. 8. Close-up view of the U.S. Multi-Slide machine for the production of captive nuts, showing the feeding arrangements for inserts. Nuts are delivered to the last stage but two from the rotary bowl hopper at the rear

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I.C.I. WROUGHT ZIRCONIUM.—Among the properties of zirconium alloys are high mechanical strength combined with outstanding resistance to corrosion by water and steam at high temperatures and pressures, and as a result these materials have many applications in connection with nuclear engineering. The Metals Division of I.C.I., Ltd., have facilities for supplying wrought zirconium, and zirconium alloys, and ingots weighing up to 3 tons can be produced by the high-vacuum, consumable-electrode, double-arc technique. Equipment is also installed for processing these billets by forging, extruding, rolling, and drawing, to produce a wide variety of shapes and sections. During processes such as melting, hot-working, annealing, and welding, precautions are taken to avoid contamination by nitrogen, which impairs corrosion resistance at high temperatures.

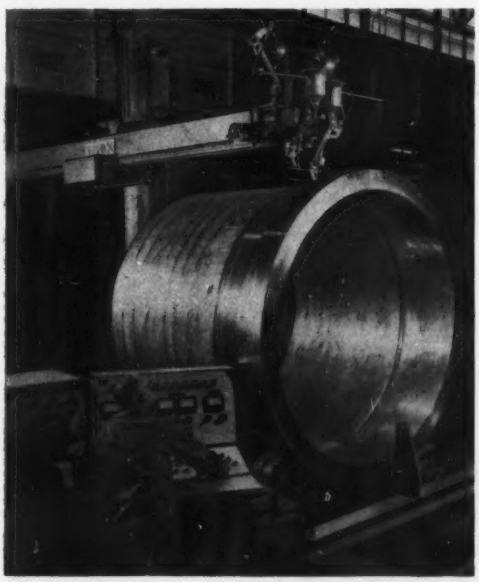
Precision Welding in Nuclear Reactor Construction

By C. R. ALLISON, Jr.,* and J. LaFORCE*

AS A FIRST MAJOR UNDERTAKING in the nuclear field, the Tapco Group of Thompson-Ramo-Wooldridge, Inc., Cleveland, Ohio, U.S.A., contracted to produce structural core members for an atomic reactor. An investigation of possible alternative welding methods indicated that the automatic submerged-arc process would ensure the high finished quality desired, and would be the most rapid and economical as regards both time and labour requirements.

Fully automatic Unionmelt submerged-arc welding equipment was selected, comprising a pair of Linde UEH-2 heads installed on a Herrick travelling manipulator, with all controls grouped on a console as seen in Fig. 1. A test circuit incorporated in the unit enables the operator to check the complete sequence before starting to weld. The welding equipment is designed for complete push-button control, and there is a 6-channel Brush Development Co. instrument which records voltage, amperage, the two electrode-wire feed speeds, and the ram and roll speeds. By means of the two welding heads, which are mounted opposite each other, a T-weld can be made on ¾-in. plate, with 100 per cent penetration, no joint preparation being required.

* Linde Company, Division of Union Carbide Corporation, U.S.A.



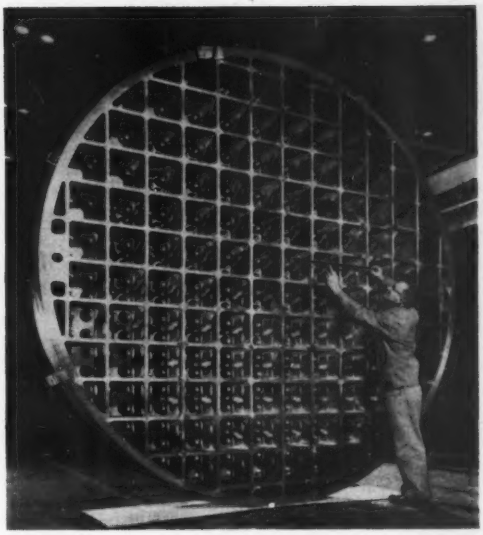


Fig. 1. Two UEH-2 heads are employed for multiple-pass, submerged-arc, welding on the outside seam of a reactor core. One man controls the entire operation from the console

The large core components, which, it is believed, are the first to have been submerged-arc welded, are of 7 ft. diameter and may weigh from 3 to 13 tons. Thicknesses from ¾ in. to 3 in. of SAE 304 and 347 stainless steel were welded with ⅛-in. type 347 and 308 electrode wire at speeds up to 24 in. per min. From 5 to 22 passes were required per weld, depending on the thickness of the plate.

In the total of 300 ft. of Unionmelt welds required in the fabrication of the reactor, radiographic inspection revealed no cracking, slag inclusions, or other defects. Actual welding time was approximately 30 hours. For manual metal-arc welding, the alternative for this type of work, Tapco welding engineers had estimated that the welding time required would be 10 weeks on a 2-shift, 5-day week basis.

For the Dreaden Nuclear Power Station, the General Electric Co. assembled the nuclear

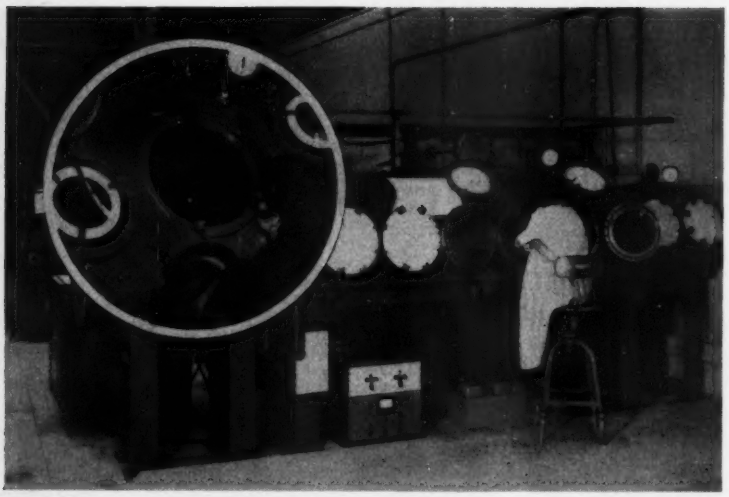


Fig. 2. Zircaloy-2 fuel-rod segment end closures are Heliarc welded in an inert-atmosphere chamber. Inert-atmosphere welding is seen in progress (inset) with the operator working through glove ports

reactor core for basic units known as nuclear fuel-rod segments. Heliarc and Sigma welding played an important part in the manufacture at every stage of fabrication.

The segment is a simple tubular jacket of Zircaloy-2 zirconium alloy enclosing a series of ½- by ½-in. uranium-dioxide pellets. The Zircaloy tube is 27 in. long and has a wall thickness of 0·030 in. Threaded end plugs are attached by Heliarc welding under inert-atmosphere conditions to seal in the pellets. Male and female threads are provided at opposite ends of the segments, four of which are coupled together to form each 9¾-ft. long reactor fuel rod.

Segments and end plugs are washed in detergent, rinsed, and dried, and finally vapour degreased. Tube ends are then etched in a hydrofluoric-nitric acid solution, rinsed, and dried. The first plug end is next attached and Heliarc welded in an argon atmosphere with 76 to 78 amp. direct current, straight polarity, high-frequency arc starting being employed to minimize cratering. The tube is rotated by a positioner beneath the torch at a speed of 14 to 15 in. per min., and each weld is completed in 8 sec. The welding is carried out inside a "dry box" chamber as seen in Fig. 2, which can be evacuated and filled with either argon or helium. Copper chill blocks are used to reduce distortion.

With one end sealed off, the tube is filled with UO_2 pellets and the other end plug attached. For this operation, a helium atmosphere is provided with Heliarc welding, and using 50 amp. at a welding speed of 24 in. per min., the plug seam is completed in only 5 sec. Batches of 100 to 150 segments can be welded before the dry-box chamber requires to be purged and recharged. Purity of the inert atmosphere within the chamber is extremely important, since Zircaloy-2 is easily corroded at welding temperatures, with adverse effects on the joint and the assembly. The quality of the fuel elements, in turn, greatly influences their reliability, and the output of the reactor.

Fig. 3. A fuel-bundle assembly, consisting of 36 cylindrical fuel rods, is here being packed for shipment to the power station where it will be fitted into a Zircaloy-2 case

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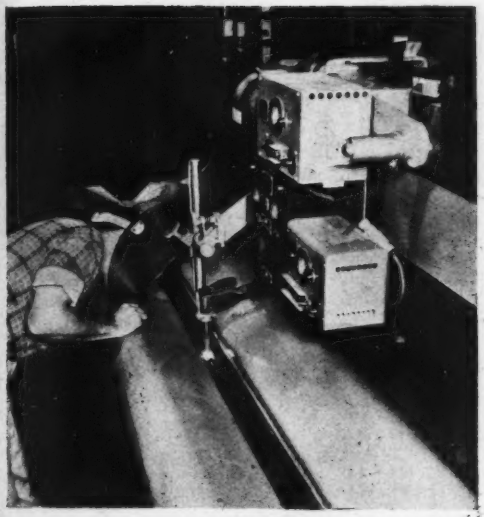


Fig. 4. A longitudinal seam in a channel which positions the fuel bundle in an electric power plant reactor core is here being welded by the automatic Heliarc process, using a side beam welding carriage

When the fuel-rod segments have been joined to form rods, the latter are grouped into fuel assemblies each consisting of six rows of six rods in a square pattern, as seen in Fig. 3. A square Zircaloy-2 channel encases the rods, and the resulting assembly is known as a bundle. This fuel bundle is slid into a channel unit in the reactor core (488 bundles make up the complete fuel core). Each channel is formed from two $\frac{1}{16}$-in. thick, U-shaped halves of Zircaloy-2, which are Heliarc butt-welded longitudinally, as seen in Fig. 4.

To enable the energy-producing reactivity of the nuclear core to be regulated, 88 control rods are spaced in the core between the fuel assemblies. These rods are of austenitic stainless steel, normally with 18 per cent chromium and 12 per cent nickel, and contain 2 per cent natural boron as the nuclear "poison" material. This absorbs the neutrons and controls the level of the chain reaction. To reduce reactivity, the control rods are moved upwards in the core through cruciform guide tubes of the form seen in Fig. 5. By moving the rods downwards, reactivity is increased, and power output raised. The 10-ft. rods have an effective poison-section (dampening) length of 8½ ft. Tests at Argonne Laboratories have shown that the service life of the control rods is three years.

The control rods are ¾-in. thick flat plates joined by a chain of interrupted weld beads 2½ in. long on 6-in. centres. Two Sigma welds are made at each joint, with a bridging fillet which reduces dilution and lessens fusion-line stress. Type E 312-16 stainless steel electrode wire is used. All austenitic welds on the control rods are fluid-penetrant inspected. A guide tube is produced by Heliarc welding two formed halves of $\frac{3}{16}$-in. thick type 304 stainless plate in a fixture.

Fuel bundles are carried vertically in the core by the bottom core-support plate. The latter rests on a ring girder that is supported by columns attached to the bottom of the reactor-vessel. An upper core-guide member holds the fuel-bundle assemblies in alignment at the top. The cylindrical support which acts as a thermal shield also rests on the ring girder at the bottom and supports the upper core-guide assembly.

The core-support plate and guide assembly are fabricated from type 405 ferritic stainless steel,

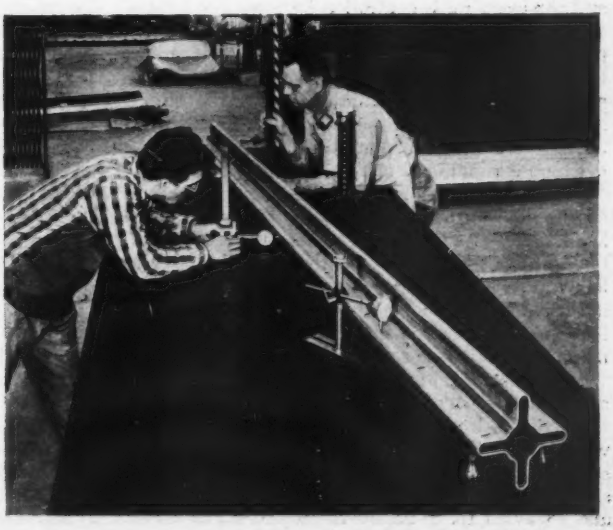


Fig. 5. Longitudinal butt-welding by the Heliarc process was employed in the construction of this zirconium alloy control-rod guide tube, here shown set up for dimensional checking on a granite surface plate

the former from 1-in. and the latter from ⅝-in. thick plate. The required grid arrangement as seen in the heading illustration is produced by Sigma fillet welding. Type E 312-16 stainless steel electrode wire is again used, and all ferritic welds are magnetic-particle inspected.

Fuel rods are leak-tested hydrostatically at 3,800 lb. per sq. in. Then they are helium-tested for microcracks in the wall, radiographed, and checked for corrosion resistance in a steam autoclave at 1,400 lb. per sq. in. for 72 hours at 750 deg. F.

Ormerod Heavy-duty Shaping Machines

The heavy-duty shaping machine shown in the illustration is representative of a range of four, with ram stroke lengths from 24 to 36 in., which has been introduced by Ormerod Shapers, Ltd., Hebden Bridge, Yorks.

Drive is from a motor of 7½ h.p. on the two smallest machines in the range and 10 h.p. on the larger shapers, and is taken through V-belts to a gearbox. The heat treated nickel-chromium gears provide 9 cutting speeds, from 8 to 93 and 7 to 82 strokes per min. for the smaller and larger machines, respectively, and selection is made by means of two levers.

No clutch is provided in the drive transmission, and the machine is controlled by means of "stop" and "start" push-buttons. A third push-button provides for inching the ram, which is then rapidly brought to rest by an electro-magnetic brake incorporated in the motor. Alteration of the ram stroke, by adjustment of the crank pin slide on a helically-toothed crank wheel, can be effected while the machine is running or at rest.

The ram is carried in deep dovetail ways, and can be adjusted longitudinally by means of a large handwheel. As shown in the illustration, a swivel-type head is provided for the tool-slide, which has a vertical traverse of 7 in. on the smaller machines in the range and 9 in. on the larger sizes. If required, provision can be made for the automatic application of down-feed.

Maximum distances of 18 and 19 in. are obtainable on the smaller and the larger machines, respectively, from the underside of the ram to the work-table. Dimensions of the T-slotted top and side surfaces of this table vary, according to the size of the machine, and range from 24¾ by 16½ in. and 18 by 17 in. to 29 by 22 in. and 23 by 20 in.

The table may readily be detached, permitting a bulky workpiece to be bolted directly to the T-slotted surface of the saddle.

Carried on ways that are shielded against falling swarf, the table saddle has a horizontal traverse of 26 in. on smaller shapers in the range and 30 in. on the larger sizes. Traversing may be effected by hand or power, and 8 horizontal feeds from 0·01 to 0·08 in. per stroke are available on each machine in the range, selection being made by means of a single lever which is provided on the front of the feed gearbox.

The Ormerod heavy-duty shaping machine here shown is representative of a range with ram stroke lengths from 24 to 36 in.

The rail has a vertical traverse of 14 in. on each of the machines, and the wide, ground sliding surfaces are also protected against the ingress of swarf. A taper gib is provided for adjustment of this slide. Vertical feed movements are obtainable at rates which are ¼th of the horizontal feeds indicated above. If required, rapid power traversing in the horizontal and vertical directions can be provided by means of a drive which is taken from an independent motor.

Lubricant is delivered to the ram guideways and the drive mechanism by a pump. A work-holding vice is supplied, the capacity of which varies from 12 in. for the smallest machine to 16 in. for the two largest sizes in the range, and extra equipment available includes a slotting attachment, together with universal and swivel work-tables. Weighing approximately 3 and 4 tons, the smallest and the largest machines require floor spaces of 8 ft. 9 in. by 4 ft. 10 in. and 10 ft. 8 in. by 5 ft. 7 in.

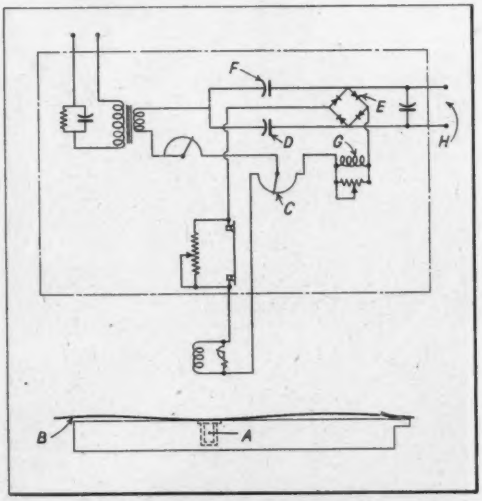
Machine Shop Patents

METHOD FOR DETERMINING FLATNESS ERRORS ELECTRICALLY

The arrangement here described provides for the determination, by electrical means, of any flatness errors of the surface of a magnetically permeable material, and may be used for the continuous inspection of strip, for example.

A series of sensing coils is employed, and is housed in recesses in a table, over which the material to be inspected is passed. These coils are arranged at intervals in a single row, extending transversely to the direction of movement of the strip, and are protected by a cover plate which is made from a material with a magnetic permeability similar to that of air. The arrangement is shown generally in the side elevation in the accompanying illustration, a coil being indicated by *A* and the strip under inspection by *B*.

The sensing coils are connected to separate, but identical, electrical circuits, one of which is shown diagrammatically in the upper view. Supplied by a voltage regulator transformer, the circuit is designed so that a current flowing to one side of the zero balancing potentiometer *C* by way of a condenser *D*, the full-wave rectifier *E*, and the sensing coil is normally balanced by the current flowing to the other side through the condenser *F*, the rectifier, and a compensating coil *G*. During setting, adjustments are made so that this balance is achieved when there is no permeable material near the sensing coil. In this condition, the electrical potentials at the upper and lower points on the rectifier are equal, and consequently there is no output signal from the circuit. However, the introduction of such material into the magnetic field of the sensing coil, when checking is in progress, causes the circuit to become unbalanced, to a degree which is proportional to the proximity of the material to the coil. An output signal is thereby obtained, at the points *H*, and may be used for the operation of indicating or recording instruments, or employed to initiate such functions as rejection, or the illumination of signal lamps. The signals derived from all sensing coils in the series can be used separately, or may be totalled or averaged, for example, as required.



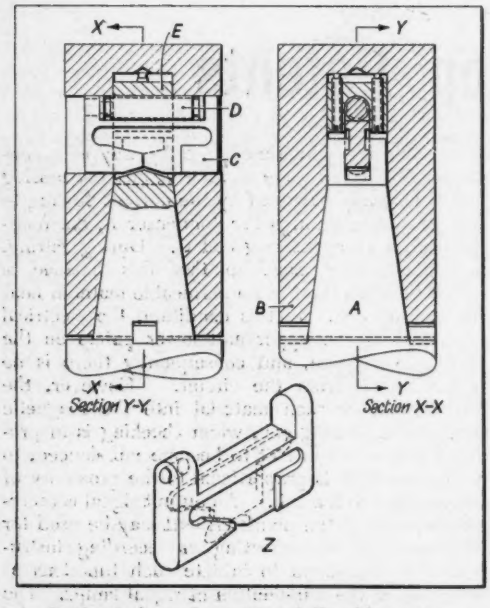
A side elevation of an arrangement whereby the flatness of a continuously-moving strip of magnetically permeable material may be checked electrically. The related electrical circuit is shown above

854,240. The Armco International Corporation, 703 Curtis Avenue, Middletown, Ohio, U.S.A. (Inventor, Mr. H. E. Brys.) *[Application date February 25, 1957. Published November 16, 1960.]*

A SCREW-OPERATED DRIFT FOR CLAMPING AND RELEASING TAPERED CUTTER SHANKS

The arrangement here described enables a taper shank to be clamped in the bore of a cutter spindle, and subsequently released, with the aid of a screw-operated drift. Referring to the sectional view on the line *XX* in the figure, the cutter shank *A* has a cylindrical portion which enters a parallel hole at the upper end of the tapered bore in the cutter spindle *B*. The increased-width lower part of a cross-slot in this extension has V-shaped shoulder surfaces at the top, and a bottom face of inverted V-shape as may be seen more clearly in the sectional view *YY*.

At *Z* is shown a perspective view, to an enlarged scale, of the drift indicated at *C* (section *YY*), which can be moved endwise in a cross-slot in the spindle *B* by means of the screw *D*. This screw is retained between lugs at the ends of the drift, and it engages with the half-nut *E*, which is housed in the upper end of the parallel bore in the cutter spindle. The



Sectional views of a cutter spindle with a screw-operated drift which provides for clamping and releasing a tapered shank

screw is rotated with the aid of a key which can be passed through a hole in the left-hand lug.

Recesses are machined in both faces of the drift, so that when the cutter is being mounted in the spindle, the slot in the end of the shank passes over the reduced-thickness central portion. When the drift is subsequently moved to the right (as viewed in the section YY) a pair of inclined contact surfaces is brought into engagement with the sloping shoulder edges at the top of the wide portion of the slot in the shank. Continued movement of the drift in the same direction then causes the shank to be drawn securely into contact with the taper bore in the spindle by the wedging action between the inclined mating surfaces. For removing the shank from the spindle bore, the drift is traversed in the opposite direction by means of the screw, to bring another inclined surface, on the central portion, into contact with one sloping face at the bottom of the slot in the shank. The wedging action of these contact faces, resulting from continued movement of the drift, then forces the shank downwards, to eject it from the spindle bore.

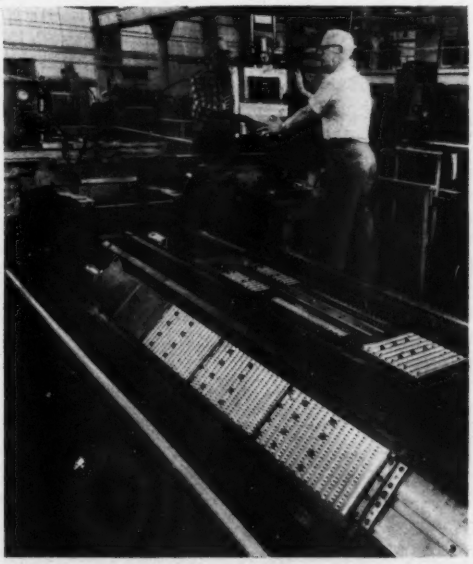
846,828. Schiess A.G., Hansa-Alle 245, Dusseldorf-Oberkassel, Germany. *[Application date, December 19, 1958. Published August 31, 1960.]*

Broaching Breech Rings

In the accompanying figure can be seen some of a number of special broaches which have been supplied by the Continental Tool Works Division of Ex-Cell-O Corporation, Detroit, Michigan, U.S.A., for machining operations on breech ring bodies. These items, one of which is seen suspended from a crane at the rear, are made from tough, high-tensile steel and each has a T-shaped aperture which is nominally 8 in. wide by 14½ in. long. The bodies are carried in shuttle-type fixtures, which are arranged for movement at right-angles to the centre lines of the broaches, and the latter are mounted on an indexing carrier, whereby they are brought to the operating position.

Broaching is carried out in two main stages, the first of which provides for bringing the narrower portion of the aperture to the required size. Only four passes are necessary, and approximately ⅜ in. of metal is removed from each side of the aperture. Next, the fixture is swivelled through 180 deg., and the wider portion of the aperture is broached, from the opposite side of the component. For this operation, eight passes are required, and approximately ½ in. of metal is removed from each side of the aperture.

There are 12 broach assemblies on the indexing carrier, and each is built up from a number of high-speed steel inserts.



Set-up for broaching apertures in breech rings

NEW PRODUCTION EQUIPMENT

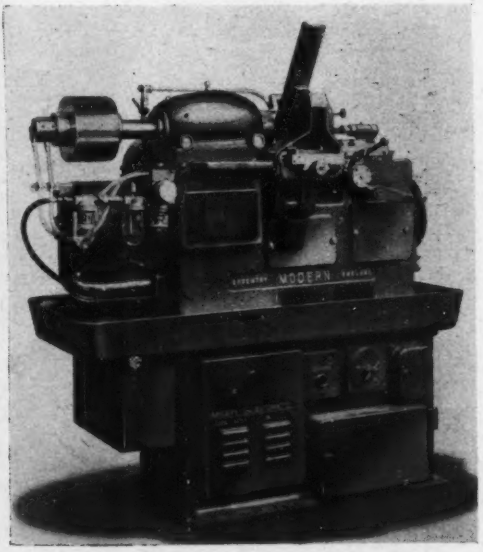
Edited by
G. W. Mason
and
A. J. Barker

"Modern" Single-spindle Chucking and Bar Automatic

Designated No. 909, the single-spindle 3-operation automatic lathe shown in the accompanying figure is built by Modern Machine Tools, Ltd., Coventry Works, Gosford Street, Coventry, and is provided with a 5-in. capacity, air-operated chuck (a manually-operated type can be supplied, if preferred). The machine illustrated is provided with a magazine feeding unit, which does not form part of the standard equipment. It is otherwise similar to the company's No. 907 bar automatic which has capacity for material of circular section up to 1¼ in. diameter, and square and hexagonal section of ⅞ and 1·01 in. across flats. The maximum feed length normally obtainable is 3 in. although provision can be made for feed increments up to 7 in.

Main drive is taken from a 3½-h.p. motor, and there are 12 speeds from 280 to 1,900 r.p.m. for the headstock spindle, which runs in adjustable taper roller bearings. A total of 48 different cycle times from 7½ to 100 sec. can be obtained. The front and rear cross-slides have traverses of 1⅜ in., and the end-working slide a longitudinal movement of 2½ in., and each of these members has multiple T-slots in the upper surface. Holders for forming or parting tools, for example, and a drill-holder are supplied with the machine, and additional holders, for turning up to 1¼ in. diameter, combined turning and drilling, and knurling up to 1⅜ in. diameter, are available for use on the longitudinal slide.

Coolant equipment is incorporated, and the machine requires a floor space of 4 ft. 2 in. by 2 ft. 3 in. A bar stand is provided, and front-loading bar feeding units are available which will accommodate bars with maximum lengths of either 8 or 12 ft.

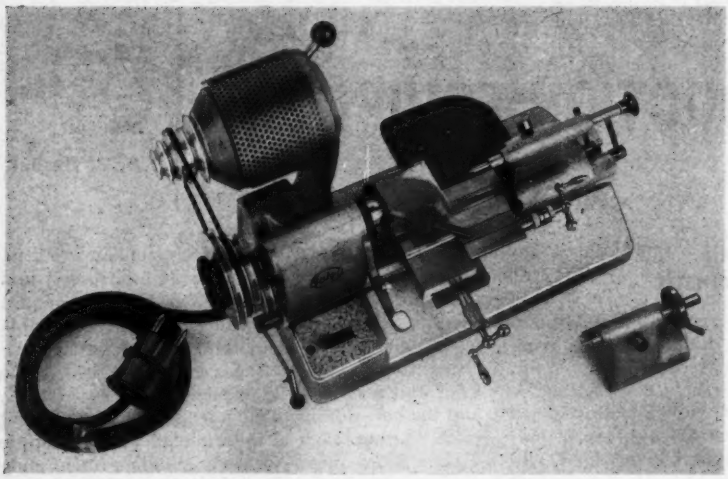


The Modern No. 909, single-spindle chucking automatic is here shown equipped with an air-operated chuck and a magazine feeding unit

Boley F 1 Precision Instrument Lathe

Henri Picard & Frère, Ltd., 34-35 Furnival Street, London, E.C.4, are the distributors in the United Kingdom for the Boley F 1 instrument lathe which is shown in the accompanying illustration. This machine has a heavy base casting 11 in. long, which rests on four large rubber pads. The bed, of semi-circular section, is provided with a longitudinal T-slot whereby the headstock, saddle and tailstock are mounted. It rests in a mating groove in the base casting and can be tilted forwards or backwards and secured by a friction arrangement in the required position.

The headstock has a 0·315-in. bore hollow spindle which may be driven directly by the upper grooved pulley shown in the illustration, or indirectly through the lower pulley. At the opposite end of the shaft on which this latter pulley is mounted there is a contact wheel situated beneath the nose of the spindle. Direct drive is employed for turning work held in a chuck, and the indirect drive for work which is held in a chuck or between centres.



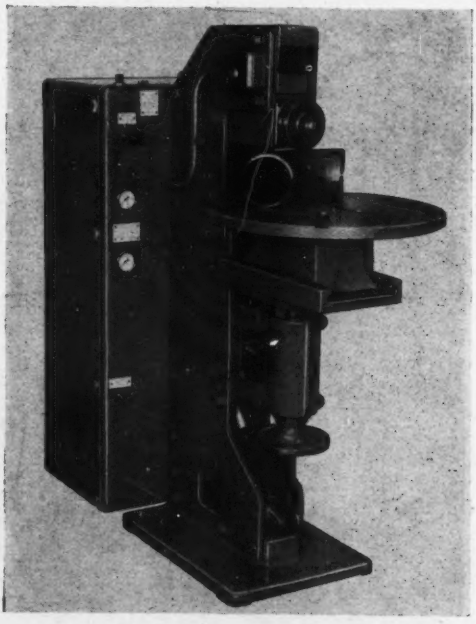
Boley F 1 precision lathe for instrument work

With the indirect drive, the spindle speed is changed by varying the position of a lever which increases or decreases the pressure between the contact wheel and a friction disc on the spindle nose. A radial arm which supports the fractional horse-power driving motor can be adjusted for belt tensioning. A 2-way switch, positioned close to the rest for the operator's wrist at the rear of the lathe, controls forward and reverse running. The main switch is located on the front of the base casting. A supplementary tailstock, shown in the illustration, is provided with a sleeve designed to receive eccentric runners.

Pryor Type E.P. 50/2 Tube Bend Marking Machine

In the accompanying illustration is shown the type E.P. 50/2 machine which has been built by Edward Pryor & Son, Ltd., Broom Street, William Street, Sheffield, 10, to produce indented markings on seamless welding tube elbows, such as are employed in oil and petroleum refinery plants. These markings normally comprise the maker's name or trade mark, the nominal size of tube, and the material and schedule number. The lettering is arranged to follow the mean radius of the bend and must be sufficiently indented to be clearly visible after subsequent stove enamelling or spray painting. Because the batch sizes of elbows are seldom large, the machine has been so designed that it can be readily set up for different dimensions and inscriptions.

Both long and short radius elbows can be handled, for nominal pipe sizes from 1½ to 8 in. and angles of 45, 90, and 120 deg. The elbow is located in position on the table, which can rotate freely, and is secured by an air clamping device (not shown). A 3-in. diameter air cylinder, operating through levers, raises a ram, on which the table assembly is mounted, and the work is thus pressed against the marking roll. The latter is then caused to turn through part of a revolution by a second air cylinder, and rotary motion is thus imparted to the work and table. There is a 2-position switch which can be set to provide for a single or



Pryor type E.P. 50/2 machine for marking seamless welding tube elbows

double (forward and return) pass of the roll before the table is lowered.

The actual rolling operation may occupy as little as 2 sec., and 4-in. diameter elbows, for example, can be marked at the rate of about 12 per min.

Benrath Type S.V. Static Balancing Machine

In the illustration is shown the latest type S.V. static balancing machine made by Benrath Machine Tools, Ltd., Empress Street, Manchester, 16. A workpiece to be checked is mounted on an adapter plate, which, in turn, is supported by a circular balancing cradle, and is located by a central, precision-ground spigot. For balancing, the cradle is lowered on to precision knife edges by movement of a lever at the right-hand end of the cast iron base, and the adapter plate—and with it the workpiece—is then turned until a maximum reading is obtained on an indicator at the left-hand side of the centre line. A sliding weight is now adjusted on a rod at the right-hand side of the centre line until the indicator shows a zero reading, and the cradle is then raised clear of the knife edges by movement of the lever in the opposite direction.

Next, the amount of unbalance, as indicated by the position of the weight on the rod, and the depth of hole to be drilled in the work to compensate for that unbalance, are noted on a scale mounted at the side of the drilling head. The drilling head can be adjusted towards and away from the centre line of the cradle on guideways at the rear of the bed, and feed is applied to the motor-driven spindle by hand. Spindle travel is pre-set by a stop in conjunction with a scale on the feed handwheel, for drilling a hole in the work of the depth required. When drilling has been completed, the weight can be set in the zero position on the rod, and the cradle again lowered on to the knife edges for checking the workpiece for balance.

The machine is available in two sizes, the smaller of which has a ⅝-in. capacity drilling head, and will handle workpieces up to 18 in. diameter by 5 in. thick, with a maximum weight of 150 lb. Weights of 1 and 2 oz., which can be adjusted over a distance of 9 in. on the rod, are supplied with this machine. Parts up to 26 in. diameter by 7 in. thick, with weights up to 300 lb., can be handled on the larger machine. It is equipped with a ⅝-in. capacity drilling head, and there is an adjustment of 14 in. on the rod for the 2- and 4-oz. weights provided.

The company's range includes static balancing machines which incorporate pairs of rollers for supporting shafts in the horizontal position. Equipment of this type can be supplied for handling workpieces up to 84 in. diameter, and weights up to 15,000 lb. The larger sizes in the range may be fitted with vertical slides, with V-shaped upper ends, which can be raised and lowered hydraulically, and enable heavy workpieces to be loaded and unloaded without the risk of damaging the rollers. The Benrath type S.E. machine for static balancing of fans, turbine rotors, and grinding wheels, for instance, is made in three sizes with capacities for handling components with maximum diameters of 12, 20, and 32 in., and widths of 6, 12, and 16 in., with weights up to 30, 100, and 200 lb.

Benrath type S.V. static balancing machine

Archdale No. 14749 Horizontal Production Milling Machine

Built by James Archdale & Co., Ltd., for whom the sole selling agents are Alfred Herbert, Ltd., Red Lane, Coventry, the No. 14749 horizontal production milling machine shown in the accompanying figure is designed for operation on an automatic cycle. Moreover, an extra unit can be added, and slight alterations made to the control equipment, which enable the machine to be operated continuously for a pre-determined number of cycles. Pendulum milling can be carried out, and cutting can be performed by either the conventional or climb method.

The table has a T-slotted working surface measuring 50 by 10½ in., and it can be traversed longitudinally through a distance of 30 in. along ways on the ribbed, box-section bed. Motion is imparted through a hardened and ground lead screw, which engages an anti-backlash nut, and feed drive is taken from a ¾-h.p. motor, through change gears whereby a total of 30 rates from ½ to 20 in. per min. may be obtained. Interlocking is incorporated so that the feed drive motor is stopped in the event of an excessive load being applied to the milling cutter. A rapid power traverse of 300 in. per min. is provided by a separate 1 h.p. motor .

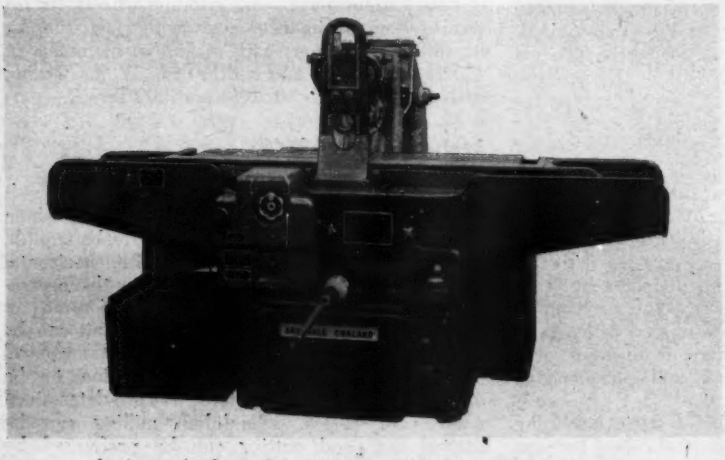
Drive to the milling head is taken from a 7½-h.p. motor, through multiple V-belts and hardened and ground change gears, and a total of 30 spindle speeds can be obtained, in either the forward or reverse direction, in low and high ranges from 25 to 317 and 70 to 880 r.p.m. The spindle is bored to accommodate a drawbar, and normally has a standard No. 40 internal taper at the nose end, but a No. 50 taper can be provided, if required. It runs in anti-friction bearings, and is mounted within a quill which can be adjusted axially through a maximum distance of 1½ in. by means of a hand-operated crank, a graduated collar being provided to facilitate setting. A maximum distance of 14¼ in. is obtainable between the spindle nose and the outboard support bracket, which is carried by two cylindrical arms. An intermediate support bracket can be supplied, if required, and the equipment provided with the machine includes a steady brace.

Vertical adjustment, for a maximum distance of 10½ in., is obtained by movement of the entire column on ways at the rear of the bed, by means of the hand crank. The maximum distance obtainable between the spindle axis and the work-table surface is 14¼ in.

During an automatic cycle, the table may be traversed, at the pre-determined feed rate, in either direction. It may be stopped at the end of the cutting stroke or, alternatively, may be returned to the starting position. The controls can also be set to return the table to the mid-position, for unloading and loading. By means of an electrical timer, the table may be caused to dwell before returning, as may be required, for example, when plunge milling.

Rapid traverse may be engaged for fast approach to the cutter, and may also be brought into operation for part or all of the return movement. When the latter arrangement is employed, rotation of the cutter spindle is arrested before the table is returned. Rapid traverse can also be engaged, during the cutting stroke, for use when performing skip milling operations.

Coolant equipment, as shown in the illustration, is available as an extra item. Weighing approximately 2 tons 8 cwt., the machine requires a floor space of 8 ft. 7 in. by 4 ft. 6 in.

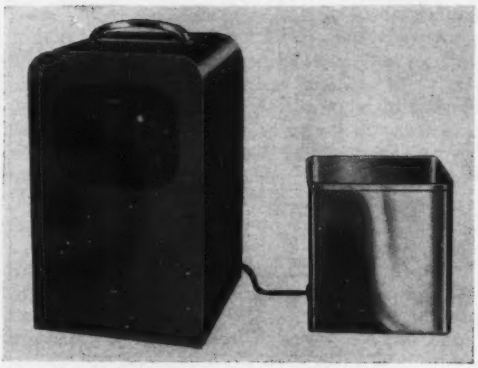


Archdale No. 14749 horizontal production milling machine

Mullard 500-watt Ultrasonic Cleaning Equipment

Mullard Equipment, Ltd., for whom Kerry's (Ultrasonics), Ltd., Warton Road, Stratford, London, E.15, are sole distributors in this country, have introduced the 500-watt ultrasonic cleaning unit here illustrated, which is designed to operate from a 200/250 volt, A.C. supply.

This general-purpose equipment comprises a bench - mounted type L364 generator, and a type L368 cleaning tank fitted with a transducer assembly. Made from stainless steel, the tank measures 8 by 6 by 10 in., and has a capacity of 1½ gal. The ultrasonic generator gives an operating frequency of 40 kc. per sec. If required, the generator can be supplied with



Mullard 500-watt ultrasonic cleaning equipment marketed by Kerry's (Ultrasonics), Ltd.

separate transducers which can be mounted in existing tanks or in any special arrangement to meet particular cleaning requirements. Each transducer measures 6 by 4 by 2¾ in. and is of stainless steel construction. Both the transducers and inside surfaces of the tank have radiused corners to ensure that dirt is not trapped.

A solvent-filtration unit, known as the type LPU60/Z, for the continuous removal of solids down to a particle size of approximately one micron, is available, if required. In addition, a type BVS10 vapour still, for use with trichloroethylene or perchloroethylene, can be supplied, either for component drying or solvent recovery. This unit is designed for bench mounting and is constructed from galvanized steel. The internal dimensions of the tank are 8 by 8 by 9 in.

Centec Automil Automatic-cycle Horizontal Milling Machine

The Automil automatic-cycle horizontal milling machine, shown in the figure, has been developed from the prototype machine which was displayed by Centec Machine Tools, Ltd., Hemel Hempstead, Herts., at the recent Olympia exhibition (see MACHINERY, 96/1622—29/6/60).

The 27- by 6-in. work-table has a longitudinal travel of 14 in., and, as on the prototype machine, traversing movements are derived from an air-hydraulic cylinder, but the range of steplessly-variable feeds has been extended up to a maximum of 400 in. per min. Rapid power traverse is provided in both directions at the rate of 420 in. per min.

Separate controls are provided, which enable different feeds to be obtained for the two directions of table traverse, as may be desirable for conventional and climb cutting, for instance, when pendulum milling is being carried out.

Cross travel of the saddle for a maximum distance of 5 in., and vertical adjustment of the knee through 7¾ in., are effected by hand, a maximum distance of 7¾ in. being obtainable between the top surface of the table and the cutter spindle. Drive is taken from a 1-h.p. motor, and six spindle speeds from 85 to 1,400, or from 170 to 2,800 r.p.m., are provided. The automatic operating cycle is started by depression of a plunger-type air valve, whereupon the table is advanced under rapid power traverse. At a predetermined point in the travel, the pre-selected milling feed is automatically engaged by an adjustable stop, and when cutting has been completed, the table is rapidly returned to its starting position. For pendulum milling, movement of the table in each direction is started by operation of the air valve by hand.

Equipment available for use on the machine includes a vertical-spindle milling attachment, automatic air-operated indexing tables, 4- and 6-in. diameter rotary tables, and quick-acting swivel and non-swivel vices.

Centec Automil automatic-cycle horizontal milling machine

Fluid-Form Hydraulic Forming Attachment for a Power Press*

By H. MÖLLER†

PROBLEMS ASSOCIATED with the production of a particular sheet metal component for a gas turbine at the works of Svenska Aeroplan, A.B., Sweden, led to the development by the company of the Fluid-Form attachment, which is intended for mounting on a conventional power press to facilitate forming components in dies with fairly deep cavities of intricate shapes. As may be seen from the three views in Fig. 1, production of this component in a single piece, in a conventional press tool with a rigid punch, would present considerable difficulties. When its production was considered, the need for a drawing tool with a split die, and a "flexible" punch which would enable sufficient specific pressure to be applied over the entire surface area of the blank, was apparent.

* Abstract of a paper presented at the conference of "Modern Trends in the Manipulation of Metals," arranged by the Institution of Production Engineers.

† Svenska Aeroplan, A.B., Sweden.

Fig. 1. Three views of a sheet metal component for a gas turbine which was produced with the Fluid-Form hydraulic forming attachment

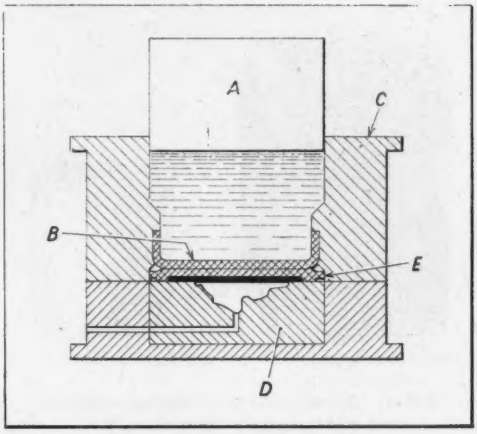


Fig. 2. With the Fluid-Form attachment, pressure for blank holding and for forming sheet metal parts is exerted by a plunger mounted on the drawing slide of a press, through a quantity of hydraulic fluid and a rubber diaphragm

With the Fluid-Form attachment, a sectional view of which is given in Fig. 2, pressure for blank holding and forming is derived from the plunger *A*, attached to the drawing slide of the press, through a quantity of hydraulic fluid and the rubber diaphragm *B* in the bore of the cylinder *C*, the latter being mounted on the drawing slide. Housed in a ring-shaped holder, the die *D* may be made from steel, cast iron, Kirksite, plastics, or hard wood, depending upon the shape of the workpiece and the number to be produced. A fairly thick rubber wear disc, as at *E*, is fitted at the lower end of the bore in the cylinder *C*, and serves to prevent the diaphragm *B* from being damaged by sharp edges on the blank while drawing is in progress.

During the downward movement of the drawing slide, constant pressure is applied to the entire surface of the blank throughout the forming cycle, since the diaphragm *B* and the wear disc *E* follow closely the shape of the part as drawing proceeds. Forming is first completed on the shallowest part of the work profile, and other portions of progressively increasingly depth are formed during the continued downward travel of the slide. As a

result, as forming is completed on each part of the work profile, the blank-holding area is increased. A hole—or a number of holes—the diameter of which should not be more than twice the thickness of the blank, is usually provided in the die to permit air to escape while drawing is in progress. When the slide has been returned upwards to its starting position at the end of the forming cycle, compressed air may be passed through these holes for ejecting the completed part from the die.

In Fig. 3 is shown a Fluid-Form attachment and a die of split design which is made from plastics material. Since it is necessary to remove the die from the holder at the end of the drawing operation, in order to separate the halves for unloading the part, this equipment should be used on a press which incorporates an air cushion or other ejector arrangement.

For producing certain components with large surface areas, it may be necessary for the drawing to be carried out in several stages, and to anneal the partly formed workpiece at the end of each stage. A filler piece made from hard rubber or other flexible material should then be inserted in the cavity at the beginning of each drawing stage, as indicated at *F* in the upper view Fig. 4, to ensure

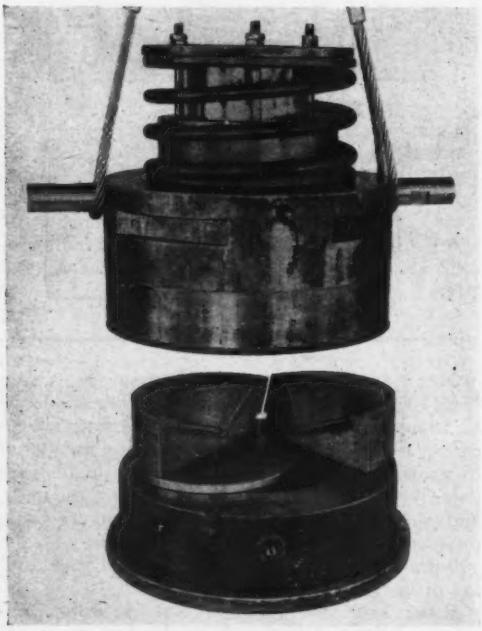


Fig. 3. A Fluid-Form attachment and a die of split design, which was made from plastics material

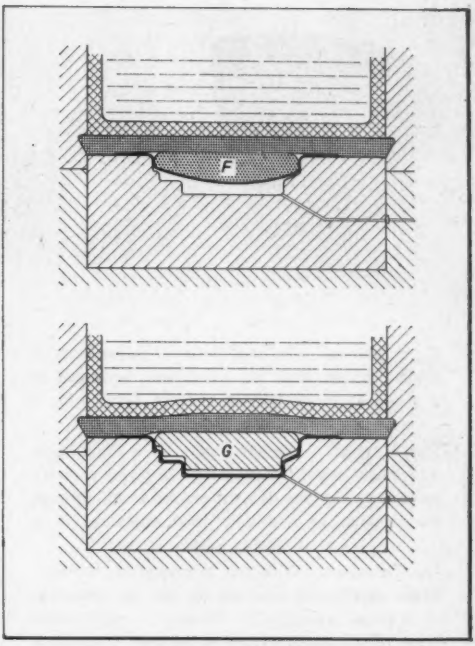


Fig. 4. (upper view) When forming is to be carried out in several stages, a rubber filler piece is placed in the cavity of the partly-formed workpiece at the beginning of each stage, to ensure that air is not trapped. (lower view) For forming small corner radii, pressure is applied to the work by a forming piece which may be made from Kirksite or plastics material

that air is not trapped between the wear disc and the workpiece. Tests have indicated that when a pressure of 10,600 lb. per sq. in. is applied to the diaphragm, minimum corner radii of 10 times the blank thickness can be formed in Nimonic 75, 7 times in 18-8 stainless steel, 4·5 times in car body steel, and 2·5 times in soft Mg-Si-aluminium. When smaller radii are to be formed, a forming piece, which can be prepared by casting plastics or Kirksite in the die cavity, may be interposed between the wear disc and pre-formed workpiece as indicated at *G*.

Fluid-Form attachments may be used on presses up to 3,000 tons capacity, which should preferably be of the hydraulically-operated type, since the forming pressure can then be accurately controlled irrespective of the position of the drawing slide, and is usually indicated on a gauge. The diameter of the diaphragm in the cylinder, depends

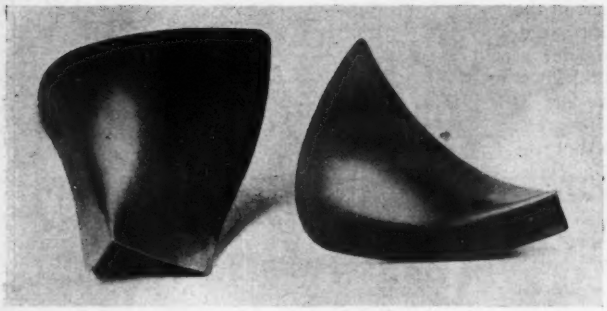
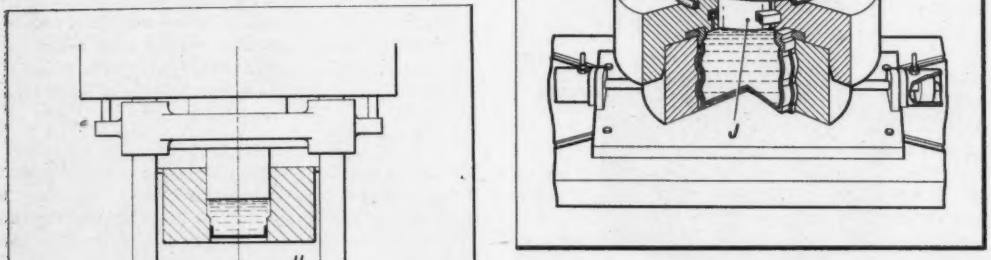
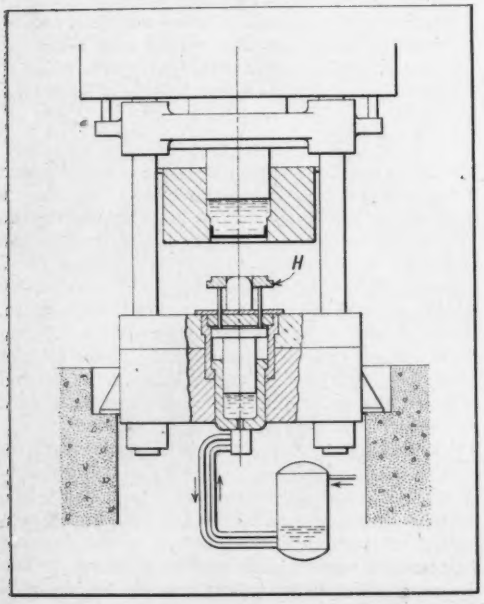


Fig. 5 (above). Two saddle-shaped components of similar design, each of which was produced at a single operation from a profiled blank with a Fluid-Form attachment

Fig. 6 (right). Sectional view of a Fluid-Form attachment, which is designed for applying pressure radially to the bore of a cup-shaped blank through the medium of hydraulic fluid contained in a rubber sack

Fig. 7 (below). With this arrangement, a Fluid-Form attachment mounted on the drawing slide of a press provides for forming a sheet metal blank over a punch secured to the bed. Forming is carried out against pressure exerted on a blank-holder by an air-hydraulic cushion in the bed





upon the capacity of the press on which the attachment is to be employed, and the forming pressure to be applied. For example, a 5-in. diameter diaphragm is required when a pressure of 11,375 lb. per sq. in. is to be applied by a 100-ton capacity press. The diaphragm diameter for an attachment for mounting on a 3,000-ton press, to provide the same pressure, is about 27 in.

Seven Fluid-Form attachments, which have diaphragms from 4½ to 19¾ in. diameter, are employed at the works of the author's company on presses from 100 to 1,000 tons capacity, for the production of a wide range of components of intricate shapes for gas turbines and aircraft, as well as a number of experimental parts for other products. In all, more than 500,000 parts have been made by these units, and components of one particular design are being produced at the rate of 200,000 per year with the aid of a Fluid-Form attachment mounted on a 100-ton press.

It was originally intended to produce the component illustrated in Fig. 5 by drawing on a conventional press tool with a rigid punch, followed by trimming, which was to have been carried out in

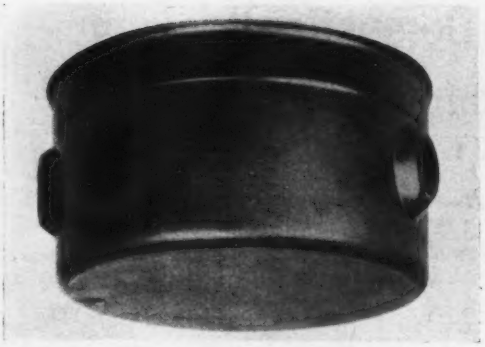


Fig. 8. Bulging, to form the projections on this cup-shaped part, was carried out with an attachment of the type shown in Fig. 7

several steps. Because of the saddle shape, wrinkles in the drawn components could not be avoided, and, in addition to presenting certain difficulties, trimming resulted in wastage of metal strip which amounted to 70 per cent of the whole. The component was subsequently produced on a Fluid-Form attachment at a single operation from a profiled blank, and the need for trimming was avoided.

Forming of deep symmetrical components may be carried out with a Fluid-Form attachment in conjunction with a punch mounted on the bed of the press, as shown in the sectional view Fig. 7. Forming then takes place against the action of a blank-holder, as at *H*, to which upward pressure is applied by an air-hydraulic cushion housed in the bed. By means of a control valve incorporated in the cushion, the pressure applied to the blank-holder can be varied, as required, during the working cycle. When forming has been completed, and the drawing slide has been returned to its starting position, the component is ejected from the punch by upward movement of the blank-holder.

Fig. 6 is a sectional view of another design of Fluid-Form attachment, which enables pressure to be applied in a radial direction to the bore of a cup-shaped pressed metal blank, by downward movement imparted to the plunger *J*, through the medium of a quantity of hydraulic fluid contained in a rubber sack. The blank is loaded into a die of split design, and with this arrangement, for example, cup-shaped components with corrugated walls can be produced, or bulging operations can be performed on components such as that shown in Fig. 8.

Waters Torque Gauges

American-made Waters torque gauges, which are sold in this country by International Engineering Concessionaires, Ltd., 39 Parliament Street, London, S.W.1, can be supplied for taking readings in either direction or in one direction only—clockwise or anti-clockwise. They are normally calibrated to a full-scale accuracy of ±5 per cent, and the range includes six 2-directional instruments for measuring from 0·05 to 40 oz./in. and 2·5 to 2,800 gm./cm. and 4 gauges for each single direction covering 0·01 to 20 oz./in. and 2·5 to 1,200 gm./cm. In addition, there is a range of instruments which are calibrated to either a full-scale accuracy of ±2 per cent or to within ±1 per cent for a specified value.

A ¼-in. capacity chuck provides for gripping the shaft of an assembly under test, as may be seen in the accompanying illustration, and the type normally fitted brings the total weight of the instrument to 7 oz. Alternatively, gauges with capacities greater than 10 oz./in. can be supplied with key-type chucks, the weight thereby being increased to 11 oz. The dial of a 2-directional instrument has separate scales for each direction, which are marked in different colours and extend through arcs of 300 deg. A " memory " needle is provided, for recording the highest torque registered during a series of checks. Of hexagonal shape, the anodized aluminium alloy body measures 1⅝ in. across the flats, and the overall length of the smallest instrument in the range is 3$\frac{3}{16}$ in.

A Waters torque gauge is here shown in use on a fractional horse-power motor

The Production of Domestic Vacuum Cleaner Components

Some Examples of Presswork at the Perivale Factory of Hoover, Ltd.

By S. C. PCULSEN, Associate Editor

IN AN EARLIER ARTICLE in MACHINERY, 97/1336—14/12/60, reference was made to some of the equipment and methods employed by Hoover, Ltd., Perivale, Greenford, Middlesex, for machining the main die cast components for their type 1334 and 652 domestic upright vacuum cleaners. Here, some examples of press-formed components for these products are considered. The latest press-shop policy places particular emphasis on safety, and for this reason second-operation set-ups have been eliminated wherever possible, with corresponding reductions in operator hazards. This outlook, in turn, has led to more extensive use of progressive multi-stage tooling than hitherto, and although the cost of tooling of this type is necessarily high, it is justified economically on account of the large quantities of pressings required.

TRANSFER PRESS

A recent addition to the equipment of the press-shop is the Schuler type PStw 125/9/255 9-station automatic transfer press (Pearson, Panke, Ltd.) shown in Fig. 1, which has a capacity of 125 tons and a stroke of 11 in. This machine can be operated at speeds from 9 to 36 strokes per min., and is employed for producing components in aluminium and mild steel, the latter in thicknesses up to 0·128 in. Handling of the coiled strip material, which is fed into the machine at the left-hand end, at right-angles to the transfer axis, is facilitated by the Atlas (Alfred Allen & Son, Ltd.) hydraulically operated loader seen in the foreground. Finished components are delivered from the right-hand end of the machine, and if they are of steel, they are discharged into a bath of dewatering oil, whence they are raised by the Bymec (Mechandling, Ltd.) elevator seen at the right, and delivered into a storage crate. Parts which do not require this protective treatment are delivered directly from the press to the crates, by way of the elevator.

Fig. 1. This 9-station Schuler transfer press, which has a capacity of 125 tons and a stroke of 11 in., can be operated at speeds of 9 to 36 strokes per min.

Some typical components produced on the press are shown in Fig. 2, where those seen in the upper row are for the type 652 cleaner, and those in the lower row for the type 1334. The upper row comprises, from left to right, a converter housing in 0·062-in. mild steel, produced in 8 stages at 20 strokes per min.; a bail grip in 0·028-in. aluminium, 7 stages, 17 strokes per min.; and a handle control lever in 0·093-in. mild-steel, 9 stages, 17 strokes per min. For the parts in the lower row, the details are as follows: handle support bracket in 0·128-in.

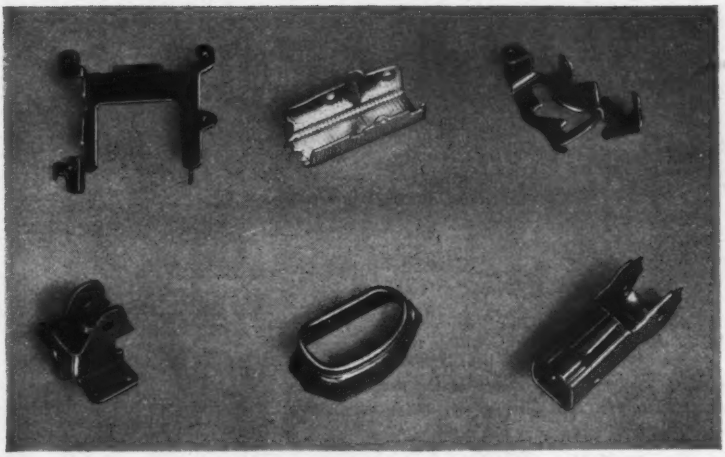


Fig. 2. Typical components in steel and aluminium, produced on the Schuler transfer press. The item at bottom left is of 0·128-in. mild steel

mild steel, 9 stages, 15 strokes per min.; dust bag flange, 0·036-in. mild steel, 9 stages, 18 strokes per min.; and a handle control socket, 0·048-in. mild steel, 9 stages, 20 strokes per min.

PRODUCING HANDLE CONTROL LEVERS

Successive stages in the production of the type 652 handle control lever, which is of bright mild steel with a hardness value of Rockwell 60 C, are shown in Fig. 3. The material is drawn from the coil through feed rollers and straightening rolls, and is blanked at the first station. Here, the blank passes through the die, and is engaged by profiled feed-fingers mounted on the gripper-rails, whereby it is transferred to the next station. Similar fingers are provided at the remaining stations, and are profiled to accommodate the progressively-changing shape of the work, as it is transferred from station to station. During transfer, the main flat face of the work slides on corresponding faces on the tools, so that it is supported at the required height, and for this purpose, the tool faces are arranged to present a surface that is, as nearly as possible, continuous.

The various operations performed at the second and ensuing stations are as follows: (2) notch; (3) form one double bend and one joggle, and partly set radius in lug *A*, Fig. 3; (4) set three lugs, including *A*, at 90 deg. to plane of plate; (5) pierce profiled cam aperture; (6) pierce ¼-in. diameter hole *B*, and shave cam aperture; (7) form second bend in lug *C*, at 90 deg., so that lug is over hole *B*; (8) half-shear spring-location in lug *D*, with a side-

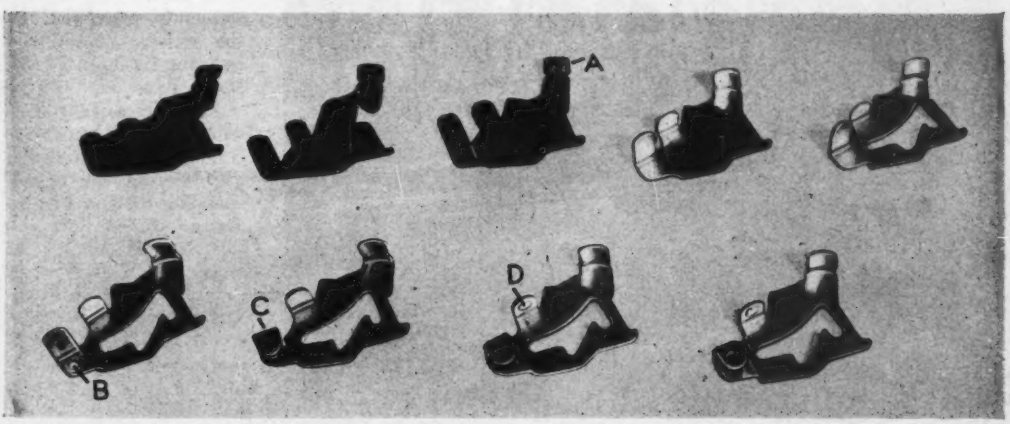


Fig. 3. Successive stages in the production of the type 652 handle control lever on the Schuler press. For this component, the press is run at 17 strokes per min.

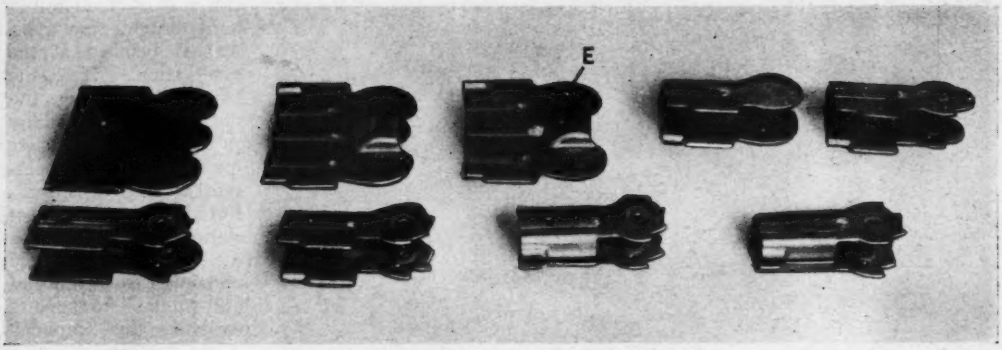


Fig. 4. Type 1334 handle control sockets are produced at the rate of 20 per min., at the successive stages here shown. The material is 0·048-in. mild steel

action tool; and (9) upwardly piece ¼-in. diameter hole in upper portion of lug *C*, in line with that previously pierced at (6). Accurate alignment of these two holes is critical, since it determines the squareness of the component on assembly, but is nevertheless satisfactorily maintained.

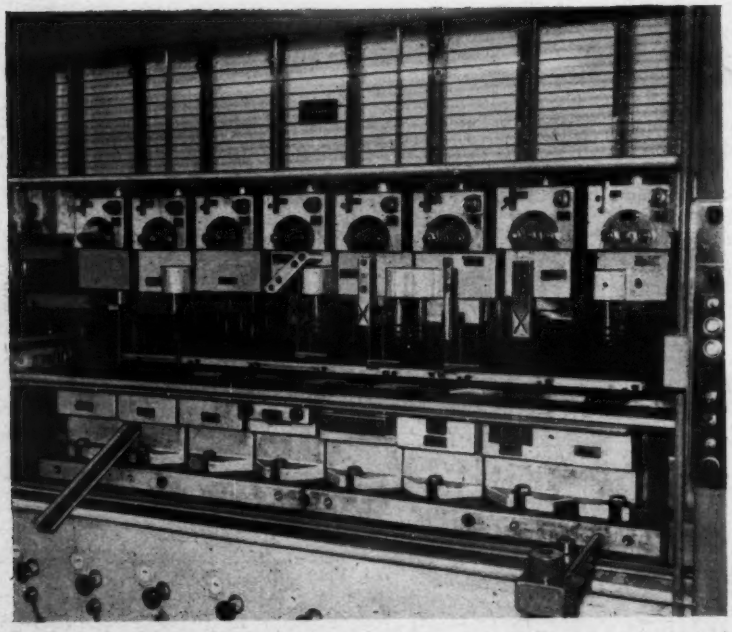


Fig. 5. The tools here shown are employed for producing the handle control socket seen in Fig. 4. Side-action tools are used at station (5) and onwards

FORMING "CLOSED" SECTIONS

The type 1334 handle control socket (bottom right, Fig. 2) is noteworthy, in that it demonstrates the practicability of producing "closed" box-section components on the transfer press. Here again, accurate alignment of the holes in the lugs is essential. This alignment is, in fact, considerably more critical than for the preceding example, since, in this instance, a slight error will result in gross out-of-squareness of the long handle that is subsequently assembled to the socket. Nevertheless, the required accuracy is achieved.

The successive stages whereby this component is formed are shown in Fig. 4, and the corresponding tools in Fig. 5. These stages are as follows: (1) blank; (2) emboss flutes, and raise radiused centre portion; (3) trim off tab from centre portion, crop notches in corners at opposite end, and form the small indented "pip" *E*; (4) form first bend, to a channel

section; (5) notch part of lug profile, and emboss for holes in centres of lugs; (6) pierce holes in one side, and finish notch lug profile on the same side; (7) repeat on opposite side, locating by the holes pierced at (6) to ensure squareness; (8) set shank flanges to 45 deg.; (9) set flanges to 90 deg., to form closed box section.

At the foregoing set-up, the tools at station (4) are so arranged that the channel section is formed with the limbs downwards, and for this purpose, an inverted U-section upper tool is employed in conjunction with a correspondingly profiled fixed bottom punch. The depth of the upper tool is such that the ends of the side portions of the form stop just short of the side-flutes of the component, at the bottom of the stroke. Thereafter, the work is transferred from station to station, in the limbs-downward position. At the remaining stations, side-action tools are employed, and to support the work internally at stations (8) and (9), a square-section articulated "floating" mandrel is provided. This mandrel is attached rigidly by the left-hand end, with the remainder free, in such a position that the work slides over it just before reaching station (8). The articulated design ensures that the work can align itself to the tools at stations (8) and (9) and when forming has been completed the component is slid off the mandrel, and discharged into a bath of de-watering oil, as previously mentioned.

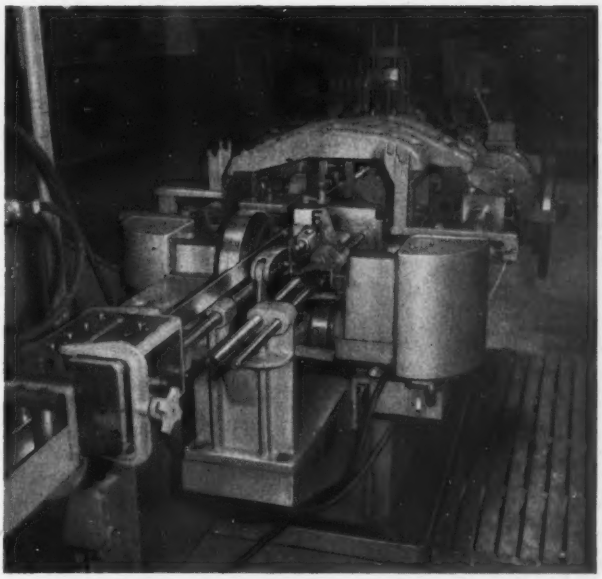


Fig. 7. U.S. Multi-Slide machine, viewed from the input end. The grip-feed mechanism is seen at *F*, and the straightening rolls at the left

Electric motor brush-holders, of the design shown at the right in Fig. 6, are produced from 0·036-in. B.S. 267 fully-annealed brass strip, 1⅝ in. wide, at the rate of 85 per min., on the U.S. Multi-Slide machine (Rockwell Machine Tool Co., Ltd.) shown in Fig. 7. The nominally square-section bores of these components are held within limits of ± 0·0015 in. on both dimensions, and the corner-joints, are made by a series of interlocking castellations. To maintain the close tolerance on the bore, it may be noted, strip material with a similar thickness-tolerance is employed.

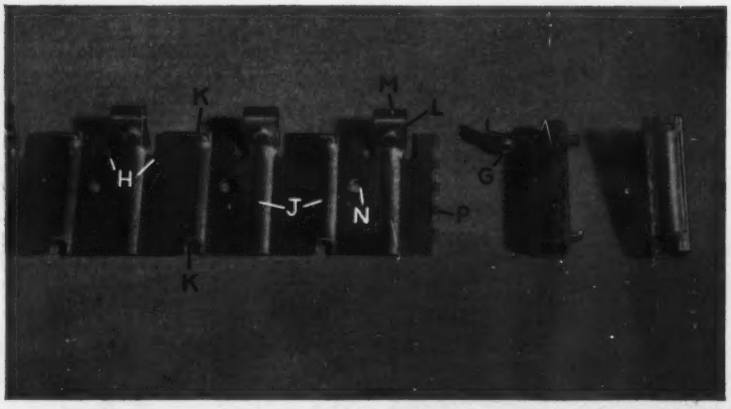


Fig. 6. Brush-holders, of the design shown at the right, are produced from brass strip at the rate of 85 per min. Part of the formed strip is seen at the left

In Fig. 7, the machine is viewed from the input end, and the straightening rolls, through which the coiled strip is drawn by the grip-feed mechanism *F*, may be seen in the left foreground. The die-set for the first horizontal slide incorporates six stations, at which the various operations performed are as follows: (1) pierce $\frac{1}{16}$-in. diameter hole (subsequently "extruded" as at *G*, Fig. 6); (2) crop right-angled notches on both sides of the strip; (3) idle; (4) crop two U-shaped notches (*H*, Fig. 6) on either side of the tab; (5) idle; and (6) indent two ribs (*J*, Fig. 6).

The strip is then fed to the second horizontal slide, where there is an 8-station die-set, that operates as follows: (1), (2) and (3) idle; (4) extrude hole *G*, 0·1 in. deep, for subsequent tapping 6NF2; (5) shear two small lugs *K*, and set at 90 deg., also set main lug *L* at 45 deg., with integral tab *M* at 90 deg.; (6) set lug *L* at 90 deg.; (7) pierce pilot-hole, *N*, Fig. 6; (8) locate from pilot-hole, to control pitch. During the foregoing sequence, it should be noted, operations (4), (5) and (6) are performed by the rear auxiliary slide, which operates in conjunction with tooling carried on the main front slide at this station.

Next, the strip is advanced through nine idle feed-strokes, to the final forming station, where there is a vertical square-section mandrel. Here, a punch of castellated profile, mounted on the front cut-off slide, shears the partly-formed work from the end of the strip, as seen at *P*, Fig. 6, and this portion is held against one side of the mandrel by the blank-holder, which is actuated by a cam on the front form-block slide. The latter then advances, to form the work to an unsymmetrical channel section, round the mandrel, and during this stage, the rear form-block is advanced, to back-up the mandrel.

Once the first two bends have been made in this manner, the rear form-block is withdrawn, and the right- and left-hand slides are advanced. The right-hand slide holds the short limb of the work against one side of the mandrel, and the left-hand slide wraps the long limb over the corner on the opposite side, to form the third bend. Thereupon, the rear slide again advances, to clinch the now-interlocking castellations. The mandrel is then withdrawn downwards, all the slides are retracted, and the work is ejected by an air-jet into a chute that directs it to the bottom of a small inclined power elevator, which delivers the finished components to a quality-control checking station.

Melbro Electro-magnetic Lifting Beams

A range of electro-magnetic lifting beams, with capacities from 2 to 20 tons, or larger if required, has been introduced by Melbro Machine Tools, Ltd., Melbro House, 2a Alexandra Road, Manchester, 15. Intended for use in shipyards and other areas associated with heavy constructional work, these beams are intended to facilitate plate handling, and it is reported that savings of 40 and 50 per cent have been achieved in handling costs. The smallest beam is provided with two electro-magnets, and for the larger sizes the numbers range up to 16. Each beam is arranged for suspension from a permanent or mobile crane, and is operated by the crane driver. The magnets are powered by the mains supply or from a 24-volt battery. In addition, the company has developed the special unit shown in the illustration for raising steel plates from a horizontal to a vertical position. It takes the form of a triangular-shaped tubular frame with a lifting hook at the apex and two M4 magnets which are arranged to pivot as the plate is lifted.

Melbro electro-magnetic unit for lifting steel plates from the horizontal to the vertical position

Shearing Disc Edges Simultaneously to Opposite Angles

AT FIRST SIGHT, the production of stamped butterfly throttle discs, as seen in the foreground in Fig. 1, does not appear to present any particular difficulty. In practice, however, it was necessary to develop a special technique to enable the required high output to be obtained, because a total tolerance of only 0·001 in. is specified on the disc edges, and they are not square with the top and bottom surfaces. These edges, moreover, must be a good fit in a circular throat machined to close limits.

The Rochester Products Division of General Motors Corporation Rochester, N.Y., U.S.A., produces many types of carburetters in large numbers. Each carburetter requires one, or two, or four throttle discs. In some designs, the disc must be a close fit with the throat when nearly, but not quite, at right angles to the throat axis. Other designs call for equally close fits when the disc is as much as 15 deg. from the right-angle position. In each case, the edge of the disc makes positive contact around approximately half the circumference of the throat and negative contact around the opposite portion. For this reason, one half of the circumference must be tapered in one direction, and the second half, in the opposite direction.

Each valve disc is first blanked (with square edges) from sheet metal, and notched at opposite sides, as shown, for the transverse supporting stem. In addition, each disc is pierced to receive screws by which it is fastened to the stem. The circumferential portions of the discs between the notches must then be cut to the specified opposing angles and to the close diameter tolerance mentioned.

Formerly, the disc edges were finished by grinding between centres, using arbors on which seven discs were clamped together at a time at the required angle. This method proved to be slow, partly on account of the time required for loading and unloading the arbors. To obtain higher production, it was decided to develop shearing tools for performing this operation on a hydraulic press. It was necessary to make different fixtures for holding the various discs at the specified angles.

To enable the operation to be performed rapidly, six fixtures are set up on the indexing table of an 8-ton Denison hydraulic press as shown in Fig. 2. With this arrangement, the work is carried out automatically, apart from the fact that the discs are loaded by hand at the front station.

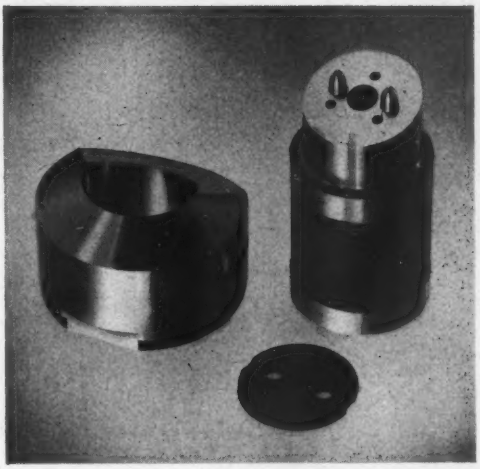


Fig. 1. Press tools for shearing a smooth contour around the edges of throttle discs to opposite angles on the two halves of the periphery

Shearing is accomplished by means of an upper die member with two tapered faces, as seen at the left in Fig. 1. The faces are ground so that the shearing cuts start and end at the notches in the discs, the edges of the shearing tool taking circular cuts progressively around the two arcs. This method ensures relatively smooth, sheared surfaces that provide the desired close fits with the mating bores in the carburetters. Little or no burring is caused during shearing. There is, however, some tendency for the blank to shift along the incline of the die member on which it is seated, but this tendency is counteracted, as described later.

Disc blanks are sized at the earlier press operation so that the shearing tool is required to remove only 0·005 to 0·007 in. of metal on each side. Only two chips are removed from each blank, and they are blown away by air jets at the shearing station and the following station, where there is a cam which operates ejector pins and a blow-off jet. All tools are made from steel and hardened, and the

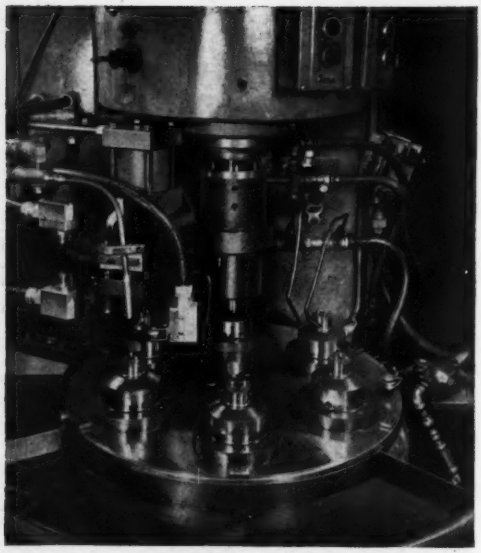


Fig. 2. An automatic indexing table on a hydraulic press enables the valve discs to be sheared at rates up to 1,100 per hour. Six work-holding fixtures, as seen at the right in Fig. 1, and one shearing tool are provided

shearing edges are kept sharp to ensure clean cuts.

As the cuts are not taken square with the disc face, it is, of course, necessary to mount each disc at the angle required on the edges. The flat face of the lower tool or punch is therefore ground to that angle. Initial positioning of the workpiece is ensured by means of two pointed pins on the die which enter mating holes previously pierced in the disc. Although these pins are a fairly close fit in the holes, the angle of the supporting punch face tends to result in a slight shift of the disc down the incline when the highest point on the edge is being sheared during the first cut.

Owing to this shifting of the work, the close diameter limits specified could not be maintained at first. For this reason, it was found necessary to dimple the discs in preparation for shearing. Protrusions formed on the under-side are a close fit in mating holes provided on the face of the punch as shown. These dimples, in combination with a spring plunger inside the upper tool, press the disc tightly against the sloping face of the punch and ensure that it does not shift. The dimples also facilitate subsequent assembly because they indicate to the operator which side of the disc should bear against the pivoting shaft.

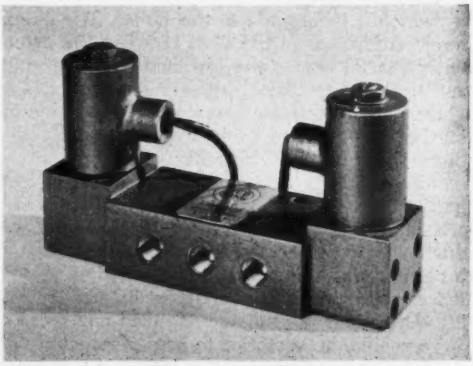
To produce the dimples, a small hydraulic press is provided at a station in advance of the one at which the shearing is carried out. Punches produce the dimples by forcing metal into the mating holes on the inclined face of the die.

The advantage of using a hydraulic press for shearing butterfly throttle discs is that the operation can be performed at a uniform pre-set speed and with the correct force to obtain smooth and accurate cuts. To ensure satisfactory results the upper tool is mounted on a ram located above the station at which the shearing cut is made, and is enclosed within a telescopic sleeve, the latter being arranged to engage a close-fitting portion of each lower tool fixture. This telescopic sleeve corrects any variation in the indexing of the fixture, and ensures accurate alignment of the shearing tool and the bottom punch. With this set-up, from 1,000 to 1,100 discs are handled per hour by one operator.

Red Ring Pilot-operated Double Solenoid Valve

Made by Stuart Davis, Ltd., P.O. Box 21, Stonebridge Highway, Willenhall, Coventry, the Red Ring pilot-operated double solenoid valve, here illustrated, provides for the control of pneumatic circuits, and is claimed to be particularly suitable for use in control cubicles and under similar conditions. Of 5-port design, with piped exhaust, this valve gives virtually instantaneous response and the current consumption is stated to be very small.

It can be supplied to suit all voltages, and in two types with ¼- and ½-in. B.S.P. connections. The ¼-in. B.S.P. unit has an overall length of 6⅝ in.



Red Ring type P805, ¼-in. B.S.P., pilot-operated double solenoid valve

Elgar Machine Tool Exhibition

Examples from the wide range of Continental-built machine tools handled in this country by Elgar Machine Tool Co., Ltd., were demonstrated recently at their showrooms at 172-178 Victoria Road, London, W.3.

Many of the machines which were displayed have already been described in MACHINERY, but reference may be made to the Giustina (Italian) type R 1 rotary-table surface grinder illustrated in Fig. 1. This machine can be supplied with a magnetic chuck of 30, 36, or 40 in. diameter, and a maximum thickness of 14 in. can be ground when a 30-in. diameter chuck is fitted. Drive to the table is taken from a 1·8-h.p. motor, and steplessly-variable speeds from 6 to 36 r.p.m. are provided. At the end of a grinding cycle, the table saddle can be moved on the bedways hydraulically under lever control, so that the chuck is brought clear of the grinding wheel, and loading and unloading of workpieces is thus facilitated. Simultaneously with this movement, safety doors at the end of the sheet metal guard are swung to the open position. After a set of fresh workpieces has been loaded on to the chuck, the table saddle is returned to the grinding position, and the doors are closed.

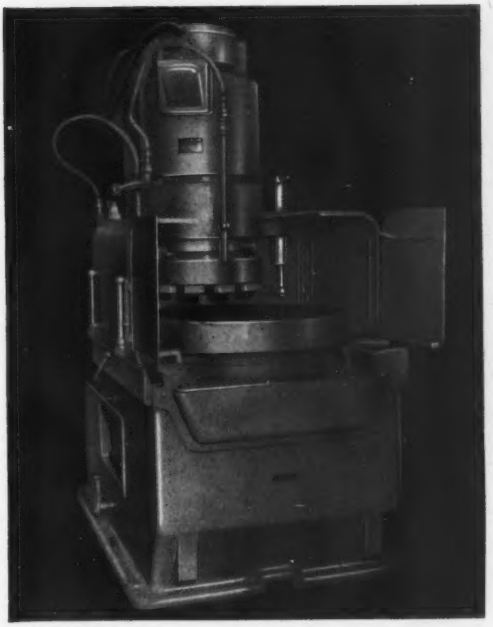


Fig. 1. Giustina type R 1 rotary-table surface grinder

An 18-in. diameter by 5-in. wide segment-type wheel is employed, and a direct drive to the spindle is provided by a 30-h.p. motor, which runs at a speed of 968 r.p.m. Down-feed movements of the grinding head are derived from the table drive, through an eccentric and a ratchet wheel and pawl, and can be applied in increments ranging from

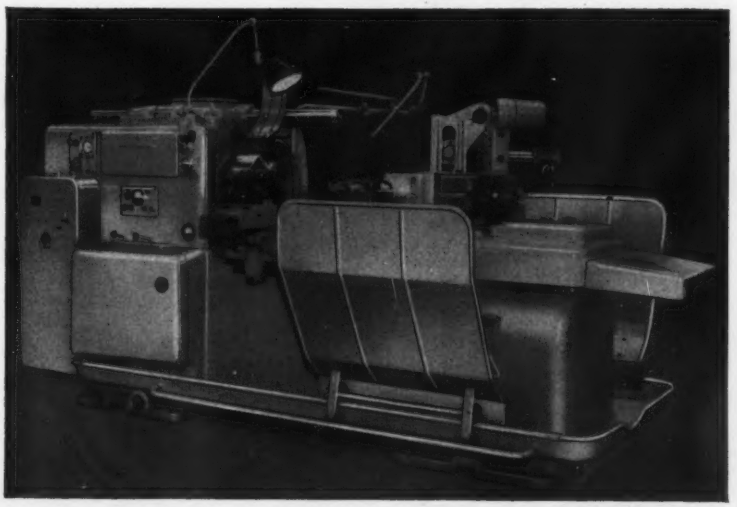


Fig. 2. The Czechoslovakian-built TOS type RB 63 semi-automatic turret lathe

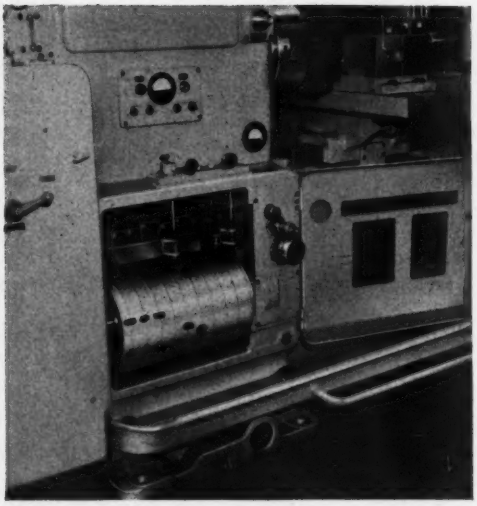


Fig. 3. Adjustable stops mounted on the drum seen in this close-up view operate air valves which control the automatic working cycle of the lathe shown in Fig. 2

0·002 in. to 0·05 in. per revolution of the worktable.

Rapid power traverse of the head in both directions, at the rate of 18 in. per min., is provided by a separate motor drive. Coolant from a reservoir of 100 gal. capacity, in the base, is delivered to the bore and the periphery of the grinding wheel by a motor-driven pump. The coolant supply is automatically interrupted when the table saddle has been brought to the work-loading and unloading position. A hand-operated swivel-type wheel dressing attachment is provided, which can be brought into use while grinding is in progress if required.

In Fig. 2 is shown the Czechoslovakian-built TOS type RB 63 semi-automatic turret lathe which was demonstrated. A maximum diameter of 24¾ in. can be swung over the bedways and 12¾ in. over the saddle, and the maximum distance obtainable between the spindle nose and the faces of the 5-station turret is 40 in. The turret slide is traversed on the bedways for a maximum distance of 13 in. by a drum-type cam, which has a groove with a variable helix angle machined in the periphery. Portions of the cam which have a high helix angle enable the slide to be rapidly traversed in a direction towards the headstock for a distance of 4¾ in. to bring the cutting tools close to the work, and quickly returned to its starting position when the cutting stroke has been completed. Holders for recessing tools can be mounted at the front and rear of the cross-slide, which has a maximum travel of 5 in. in each direction from the central position, again by a drum-type cam, and can be brought into operation simultaneously with the turret slide, if required.

Drive is taken from a 17½-h.p. motor, and spindle speeds from 18 to 1,250 r.p.m. are provided in four ranges, which are selected by sliding gears. There are 9 feeds longitudinally and transversely, which range from 100 to 317 cuts per in.

When the lathe is in operation, a drum housed in the bed as shown in the close-up view, Fig. 3, is continuously rotated, and stops, adjustably mounted on the periphery, operate a total of 9 air valves, three of which actuate multi-plate clutches in the headstock, and enable a maximum of 8 different spindle speeds to be automatically brought into use as required during the working cycle.

A fourth air valve operates a spindle brake, and of the remainder, three actuate claw-type clutches for automatically engaging different cutting feeds. Other valves provide for automatically engaging and disengaging the feed drives to the turret slide and the cross-slide. With this arrangement, a fully automatic cutting cycle is obtained, at the completion of which the lathe is stopped in readiness for unloading the work.

Lucas Hydrostatic Transmission

An article in MACHINERY, 97/1348—14/12/60, described a new hydrostatic transmission which is being marketed by Lucas Industrial Equipment, Ltd., The Radleys, Marston Green, Birmingham, 3. We are informed that only the high-speed type motor is made by the company, and is available in five different sizes, namely, types IM.60, IM.125, IM.500, IM.1000, and IM.3000. In these designations, the figures represent the displacements of the units, in gal. per hour, at an output speed of 1,000 r.p.m. Various units in the range operate at maximum speeds of 2,000 and 4,000 r.p.m., and they are rated at 3,000 lb. per sq. in. for continuous running, and 5,000 lb. per sq. in. for intermittent operation.

The low-speed type of motor, which has five pistons, is made by Chamberlain Industries, Ltd., Staffa Road, Leyton, London, E.10, and has a maximum speed of 100 r.p.m. The displacement at this speed is 67 gal. per min. At the continuous rating operating pressure of 2,300 lb. per sq. in., the torque output is 5,500 lb.-ft., and at 3,000 lb. per sq. in. it is 7,000 lb.-ft.

In the article quoted above, mention was made of the dynamic braking properties of the pump unit when the cam plate is returned to the zero position. It may be mentioned that for vehicle applications it is usually obligatory, by law, to provide a parking brake.

New London Transport Research Laboratory

The new research laboratory which was formally opened recently at the Chiswick works of London Transport is intended to provide improved facilities for quality control and testing of materials and equipment for road and rail services. Research facilities were first established at the Chiswick works in 1921 by the London General Omnibus Co., but the scale of such work has since been considerably extended, and prior to the provision of the new premises, it was carried out in a number of separate buildings.

Investigations for quality control are carried out by the Research Department on a very wide variety of materials, including metals, fabrics, plastics, and adhesives, also on electro-plated parts, welded components, and compressed air and electrical equipment. In addition, much research work is undertaken in connection with paints, fuel for diesel engines, and lubricants, and it is reported, for instance, that as a result, savings of £200,000 per year in the cost of diesel fuel, for buses, and £80,000 per year in the cost of oil for rear axles, have been obtained. Other work that has been carried out has enabled the life of batteries to be doubled, thereby saving £50,000 per year.

The new 2-storey building has a total floor area of 27,000 sq. ft., and there are chemical laboratories, a library, a conference room, and administration offices on the first floor. A machine shop, and engineering, metallurgy, and physics laboratories, are provided on the ground floor. These facilities include a screened room which houses a 260 kV. industrial X-ray set for radiographic examination of metal parts, and will be available for gamma-radiography of thick steel components with a 5-10 curie source of cobalt 60. In addition there is a 14-ft. by 9-ft. by 8-ft. high, cold chamber in which any desired temperature down to about 0 deg. F. can be maintained, for studying cold weather operation of compressed air equipment, and water cooling and heating systems, also for investigations on de-icing fluids.

In the accompanying figure is shown a machine which has been developed at Nottingham University for carrying out fatigue tests on axles for railway coaches. With this machine it is intended to investigate the effects on fatigue strength of shrink fits, and surface rolling, with and without subsequent light machining. A 6½-in. diameter by 5-ft. long test piece is held at the ends in two heavy discs, and the assembly, which has a natural frequency slightly below 50 cycles per sec., is suspended by a steel cable. When testing is being carried out, the lower end of a rigid tubular extension piece, attached to the bottom disc, is caused to move through a circular path at a speed which corresponds to the natural frequency. In consequence, the assembly is caused to vibrate to apply a rotating stress to the specimen.

A variable-speed drive is provided by a 25-h.p.

This machine, for carrying out fatigue tests on axles for railway coaches, is installed in the new research laboratory at the Chiswick works of London Transport

d.c. motor which is supplied by a Ward-Leonard set. From the motor, drive is taken by a vertical shaft which has a variable-throw eccentric at the upper end to enable variable stress loads to be applied to the test piece, and finally to the extension piece through a special hydraulic clutch. This clutch prevents the application of excessively high forces when the drive is being started and stopped, and the speed of the test piece does not coincide with the resonant frequency. The design of the drive system is such that the rotating members are balanced irrespective of the radial setting of the eccentric. Stresses applied to the test piece are measured by resistance strain gauges, which are calibrated after they have been mounted in the required positions. A console at the right-hand end of the machine houses the strain measuring apparatus, equipment for operating the clutch, and various safety interlocking controls.

It may be mentioned that investigations concerned with the distribution of residual stresses in cold rolled wheel seatings on railway axles are being carried out at Nottingham University for British Railways and London Transport under the auspices of the Research Co-ordination Committee of the British Transport Commission. The effects of different cold rolling pressures on the distribution of residual stresses in the surface layers of the wheel seatings are being studied, also stress distribution on wheel seatings of different diameters, and the plastic flow of metal which results from cold rolling. Work so far completed has shown that the residual compressive stresses induced in an axle by cold rolling have a maximum value at the surface of the metal. Axles which have been oil-quenched and tempered following cold rolling have slightly higher residual stresses than those which have been normalized. For axles made from steel with from 0·25 to 0·4 per cent carbon, the maximum compressive stress increases slightly with the higher carbon contents. When the steel contains 1·5 per cent manganese, there is a small increase in the maximum residual stress for normalized or quenched and tempered axles.

Letters to the Editor

[The Editor does not hold himself responsible for the views expressed by his correspondents.]

Programming for Numerical Control

[*To the Editor of* MACHINERY]

SIR,—In the article "Programming for Numerical Control" (MACHINERY, 97/1173—23/11/60) the use of a desk calculator and trigonometrical tables arranged in deg. and min. (at 1-min. intervals) is recommended. Such equipment is quite satisfactory for simple calculations of the type given on p. 1176—namely, 12·2302 + 1·25 cos 50 deg. 26 min.—for which, incidentally, the correct result is 13·0264.

I would point out, however, that addition and subtraction of deg. and min. cannot be performed on a desk calculator, since the latter operates in tens, and it is therefore an advantage to employ trigonometrical tables in which the angles are expressed in deg. and decimals of a deg. This system is followed, for example, in "Peter's Seven-place Values of Trigonometrical Functions," published by Van Nostrand and obtainable from Scientific Computing Service, 23 Bedford Square, London, W.C.1 (price 86s.).

Rugby. A. M. GUNNER, A.M.I.Mech.E.

[Mr. Gunner is quite right in pointing out that the result of the expression 12·2302 + 1·25 cos 50 deg. 26 min. is 13·0264, and we apologise for any inconvenience that the incorrect figure given in MACHINERY may have caused.—EDITOR.]

Machine Tool Distribution

[To the Editor of MACHINERY]

SIR,—I have read with much interest, in MACHINERY, an account of the luncheon of the British Association of Machine Tool Merchants and a subsequent letter by Mr. H. O. Barrett of the Machine Tool Trades' Association. I feel that Mr. Barrett may not have correctly interpreted the "new look" he ascribed to the presidential address. Reference was made in it to the foreign machines that are imported to satisfy the needs of merchants which could largely be met by U.K. manufacturers. It is probably true that the Importers' Section of the M.T.T.A. is responsible for the bulk of these imports, but this has no bearing whatever upon the matter. Importers are acting as merchants whether or not they belong to an association. Incidentally, many members of the Importers' Section of the M.T.T.A. are also members of the B.A.M.T.M. It is not possible, from any one particular source, to obtain the respective values of standard and special machine tools imported, but if one refers to the official catalogue of this year's International Machine Tool Exhibition one can gauge these proportions with fair accuracy.

Machine tool imports are running at the rate of nearly £23,000,000 per annum. Total British production is approximately £90,000,000 of which £23,000,000 is exported, leaving the total home consumption at £67,000,000, of which £10,000,000 may be special machines. If, as estimated from the Exhibition catalogue two-thirds of the machines imported are standard, the British manufacturer

could supply another £15,000,000 or 26 per cent of home requirements. This hardly substantiates the statement in the Mitchell Report that "Over the years the industry has supplied users with almost all their requirements of standard machine tools."

While the Report does not indicate the path taken by these machines between manufacturer and user, I estimate that 25 per cent of these imports are purchased from the British agents by merchants, sometimes for their own stocks, for satisfying the needs of their customers, because of:—

(*a*) the shortage of particular British made machines to offer, and (*b*) the extensive knowledge that the merchant has of the suitability of imported standard machines to satisfy demands, where the British counterparts are not available to him.

It would be wrong not to attribute a profit motive in the overall desire of merchants for the regular supply of standard machine tools. So far as I can see no one has suggested that merchants are at present suitably equipped to handle special purpose machine tools. If the volume of new British machine tools was available for the merchants to sell, those who at present may not have the desired facilities for stocking, installation, and servicing, would soon make it their business to provide them.

The Mitchell Committee have been naive in rejecting the idea of holding stocks during times of depression when the profits are low, labour forces have to be reduced and economies made to "weather the storm." Mr. Barrett in his letter sides with the view of the Mitchell Committee and refers to the manufacturers having preached the Committee's "gospel" on a world wide scale for many years. This is entirely unrealistic. Every user will look after his own interests rather than those of machine tool manufacturers.

Those merchants who normally stock British-manufactured or imported machine tools were able to give valuable assistance to their principals during the recent depression in the industry and held a considerable value in machine tools for a long period. When trade recovered from the depression their machines were available for immediate delivery, while the manufacturer was regaining his labour force to meet the new orders that were coming in.

A buffer between manufacturer and user cannot be anything but a desirable thing. The placing of forward stock orders by the merchant enables the manufacturer to plan for a bigger and more regular production and similarly forward order his bought-out parts. It would obviate the violent fluctuations which have taken place in the machine tool manufacturing industry which have resulted, in some cases, in almost a shut down of production in one year, and in the next, delivery dates becoming extended to two or three years. The merchant also has that most necessary function of being able to relieve the user of an unwanted machine, not only to provide space for the new one, but part of the wherewithal to purchase it.

A well thought out scheme of distribution using the merchant as a stockist, with a properly constituted franchise, would obviate cancellation of orders or deferment of deliveries in a slack time.

The total value of new machine tools sold in any one year by factors and merchants is not accurately ascertainable, but the British Association of Machine Tool Merchants conservatively estimates it at £17,000,000 per annum. If the merchants' functions, particularly those concerned with part exchange, were stifled, it would have serious repercussions on the manufacturers of British standard machine tools. Conversely, the fostering of trade through merchant channels would benefit all.

When Mr. Barrett next requires to change his motor car will he be happier, achieve more success, get earlier delivery, better service, and a satisfactory part-exchange price, by going to the manufacturer of the new car of his choice?

G. A. PARKER.

Alperton, Middlesex.

Books Received

I.W.S. SUPERVISOR'S HANDBOOK AND DIARY. The Industrial Welfare Society, Robert Hyde House, 48 Bryanston Square, London, W.1. [Price 5s.]

Now in its second year of publication, this handbook, which is of convenient pocket size, includes, in addition to a diary section, articles concerned with many aspects of a supervisor's work.

WORKSHOP ENGINEERING PRACTICE, VOL. 1, FITTING. By H. G. Rider. Iliffe & Sons, Ltd., Stamford Street, London, S.E.1. 150 pp. [Price 9s. 6d. net.]

Various tools and their uses are here discussed, including saws, shears, files, and scrapers, also measuring instruments, drills and screwing tackle. In addition, reference is made to the drilling machine. A practical exercise in fitting is detailed, and safety in the workshop is considered. The book provides a moderately priced and well compiled introduction to bench-work.

WELDING HANDBOOK (4TH EDITION), PART III, SPECIAL PROCESSES AND CUTTING. American Welding Society. Cleaver-Hume Press, Ltd., 31 Wright's Lane, London, W.8. 500 pp. [Price 72s. 0d. net.]

A diversity of methods is included in this book, as will be evident from the following chapter headings: forge welding, thermit welding, induction welding, surfacing, metal and ceramic spraying, brazing, soldering, welding of plastics, adhesive bonding of metals, oxygen cutting, arc cutting, ultrasonic welding, welding by cold working, and stud welding. In spite of the wide range covered, each chapter contains a considerable amount of information of a strictly practical nature.

NEWS OF THE INDUSTRY

Halifax

WILLIAM ASQUITH, LTD., inform us that the overall trading position of the company is at present very satisfactory. Orders for standard machines have been maintained at a steady level, and there has been an increase in connection with radial drilling machines. A heavy demand is being experienced for unit-head machines, for use in the motor car industry, and numerous enquiries which are being received for this type of machine include many from the export markets. The heavy types of machines, including floor and ram type borers, are in steady demand, and a flow of enquiries and orders is being received for special machines apart from those of unit-head type. Among the recent orders was one for a continuous rotary milling machine for China. Machines seen in production in the works included a 10-in. ram type borer which will weigh approximately 250 tons and will have a vertical traverse of 13 ft. 6 in. and a horizontal traverse of 33 ft.; two multi-spindle drilling and tapping machines for India; a number of profile millers and unit-head machines; and a 10-ft. capacity O.D.5 radial drilling machine.

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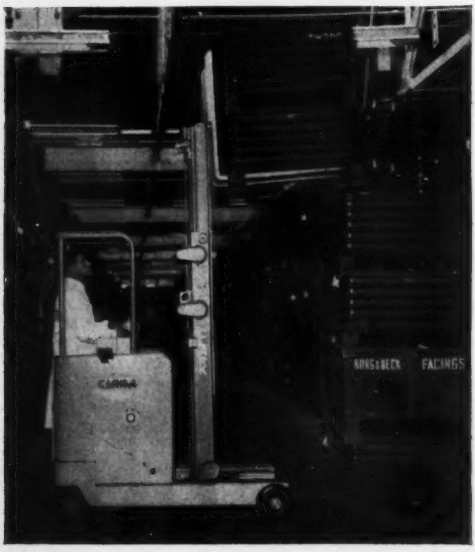
The illustration shows the Clark N.R.40 reach truck which is to be made under licence by I.T.D., Ltd., Webb Lane, Hall Green, Birmingham, 28. With a rated capacity of 4,000 lb. at 24-in. load centre, and a standard lift height of 130 in., this 4-wheeled, battery-powered truck can be operated in a gangway only 7 ft. 6 in. wide. In consequence, it is claimed, considerable economies in storage space can be obtained. The truck is here seen in use at the works of the Lockheed Hydraulic Brake Co., Ltd., where it has enabled the width of stores gangways to be considerably reduced



GRAHAM & NORMANTON, LTD., Dunkirk Mills, Dunkirk Lane, report a continued heavy demand for all the machines in their range. Recent orders have covered standard type centre lathes and shaping machines, a 17-in. centre lathe with a 64-ft. long bed for export to Norway, and a 33-in. centre lathe with a 35-ft. long bed for use in the paper machinery industry.

Work in progress includes a No. 8 keyseating machine which is being built under licence from Carter & Wright, Ltd., Halifax, various sizes of standard centre lathes, and a 15-in. centre by 24-ft. lathe, with a 30-h.p. driving motor and hardened and ground gears in the headstock.

KITCHEN & WADE, LTD., Arundel Street, are busy with the production of their range of machine tools, including standard radial drilling machines up to 8-ft. radius by 3½-in. diameter capacity, plate drilling machines, and horizontal boring and milling machines.

A heavy demand is at present being experienced for multi-spindle and special purpose machines incorporating unit heads, a large proportion of these machines being required for the motor car, heavy vehicle, and tractor industries.

THE BUTLER MACHINE TOOL CO., LTD., Mile Thorn, report a satisfactory order position for all their machines, with an increase in the number of enquiries from customers both at home and abroad.

We are informed that good results have so far been experienced from the Machine Tool Exhibition at Olympia and that the works are at present operating to capacity on a variety of machines, including double-column and openside planers, production and precision slotters, puncher slotters, and shapers of the conventional, hydraulic, and traversing head types.

A spiral-electric planing machine, which has recently been completed, weighs approximately 70 tons. This machine has a capacity of 20 ft. long by 8 ft. wide by 6 ft. high, and is driven by a 75-h.p. main motor. It has been built for Régie Renault, Billancourt, Paris.

BENCHMASTER MACHINE TOOLS, LTD., Well Lane, report a continued heavy demand for their range of machines and equipment, including the Benchmaster high speed metal sawing machine.

PORTLAND ENGINEERING CO., LTD., Eastfield Mills, Horley Street, Claremount, are occupied with mild steel fabrication work for the agricultural, earth-moving, and tractor manufacturing industries.

A heavy demand is being experienced for the company's products, which include stainless steel sink units and steaming ovens for industrial use, sterilizing equipment, and dyeing vessels. Argon-arc welding and profile cutting of stainless steel are also carried out, both for their own requirements and on a contract basis for other firms in the district.

S. APPLEYARD & CO., LTD., Grantham Road, Boothtown, report an increasing demand for their punching and shearing machines, and a satisfactory call for punches, dies and shear blades.

A steady flow of orders for repair and renovation work on all types of sheet metal working machinery is being received. A certain amount of new plant is shortly to be installed in the works, including a Binns & Berry 8½-in. centre lathe with a capacity of 6 ft. between centres.

STANLEY MACHINE TOOL CO., LTD., New Bank, have experienced during recent months an improvement in the volume of orders for their standard type centre lathes. Business in sliding bed type lathes continues to be satisfactory, and there has been an increase in the demand for special machines. New equipment shortly to be installed includes a Ward No. 3A capstan lathe and a Sykes gear generating machine.

A. KITCHEN-D. WALKER, LTD., Hexagon Works, Pellon Lane, are working overtime on the production of the type E.3. (3-in. capacity) and E.2. (2-in. capacity) elevating arm radial drilling machines, and unit heads for boring, milling, drilling and tapping. We are informed that great interest was shown when their machines were recently exhibited in Chicago, U.S.A., and that results to date are regarded as quite satisfactory.

The level of orders is well maintained and it was noted that among the machines at present in production a number is destined for export to various countries including Canada, New Zealand and the U.S.A., also that machines have recently been despatched to South Africa and Australia.

This company is at present developing a number of new machines of which we hope to publish full details in subsequent issues.

To enable output to be increased, a number of new machine tools has recently been installed, including a Sunderland gear planer, a Newall hydraulic grinder, a bevel gear cutting machine, a Ward No. 8 turret lathe, and a type E.2 radial drilling machine made by the company.

JOHN MITCHELL & CO. (HALIFAX), LTD., Godley Road, are experiencing a steady demand for their standard 8½-in. centre lathe both from the home market and for export, and report an increase in the call for special machines. A special-purpose machine with a short bed and a 48-in. diameter faceplate was seen in progress in the works.

AJAX MACHINE TOOL CO., LTD., Johnson Street, Pellon Lane, report an increase in the demand for their range of machine tools, and particularly for the 16-in. by 10-in. table milling machine. Other products include radial drilling machines up to 8-ft. radius.

Machines at present in progress are scheduled mainly for delivery in the United Kingdom, but a certain number is destined for export to the Middle and Far Eastern countries.

R. SUTCLIFFE.

Warwickshire

ALFRED HERBERT, LTD., Edgwick, Coventry, are busy on a wide range of machine tools for the home market and for export. The manufacturing programme covers capstan, combination turret, hexagon turret, copy turning, and automatic lathes; vertical milling machines; and drilling machines; also Herbert-DeVlieg Spiramatic type 2 B-36 and 3 H-48 Jigmils and Keller tracer-controlled milling machines, which are built under licence.

Facilities are offered for inspecting a wide range of machine tools in operation under production conditions and information relating to production methods and tool layouts can be supplied if required.

KENILWORTH GAUGE & TOOL CO., LTD., Station Road, Kenilworth, Warwickshire, are still very busy with the production of gauging equipment, jigs, fixtures, press tools, and special machine tools. Work recently undertaken has included equipment for grading taper rollers for bearings, and a number of press tools for making parts for still and cine cameras. Form grinding is extensively employed for the production of press tool parts, and the equipment installed for this purpose

includes a Wickman optical profile grinder and a Diaform wheel forming attachment. We may also note that tools with form-ground tungsten carbide inserts are frequently supplied.

Equipment installed includes toolroom lathes by Boley & Leinen, Weisser, Woodhouse & Mitchell and Schaublin; surface grinders by Brown & Sharpe; universal grinders by Jones & Shipman; a Hauser 3SM jig grinder; a Société Genevoise Hydroptic B jig borer; a Huron KU 4 milling machine; Radyne induction heaters; and a Rowenarc flame cutting and profiling machine. Adjoining premises are equipped with I.C.I. salt bath furnaces, and heat treatment is undertaken for the trade.

GREY & RUSHTON (PRECISION TOOLS), LTD., 93 Far Gosford Street, Coventry, are occupied with the production of a wide variety of measuring instruments with vernier scales, for the home and export markets. A good demand is reported for height gauges up to 48 in. capacity, depth gauges, hardened and ground V-blocks, and sine bars. A range of precision ground toolmakers' cylindrical squares has been introduced, in sizes from 2¼ in. dia. by 8 in. long, up to 3 in. dia. by 12 in. long. Machine tools recently installed include a Myford type MG 12 cylindrical grinder.

F. W. HERRIDGE.

Communication Systems for Production Departments

(*Continued from page* 3)

section has been established, many refinements can be introduced, and the arrangements for work programming and progressing can be incorporated as an integral part of the system. Not the least of the benefits that may then be gained is the elimination of all paper work from the shop floor.

There is no doubt that machine utilization in many factories could be improved and greater regularity of production ensured, by the comparatively simple expedient of linking the individual units to some form of recording installation, and the possibilities deserve careful investigation.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS. *Doncaster Section.* January 10, at 7 p.m., at the New Technical College, Doncaster; lecture on "Tracer Control of Machine Tools," by H. C. Town. *Liverpool Section.* January 11, at 7.30 p.m., in Liverpool International Library, William Brown Street, Liverpool; lecture on "Recent Developments in the Soviet Union," by Dr. D. F. Galloway, B.Sc., Wh.Sch. *Luton Section.* January 10, at 7.30 p.m., at Luton College of Technology (Room 235), Park Square, Luton; lecture on "Operational Research Techniques in Production Engineering," by J. Murdoch, B.Sc.

JUNIOR INSTITUTION OF ENGINEERS. January 13, at 7 p.m., at Pepys House, 14 Rochester Row, Westminster, London, S.W.1; paper on "Xerography and Allied Subjects," by W. C. C. Ball.

INSTITUTION OF MECHANICAL ENGINEERS. *North Western Branch.* January 12, at 6.45 p.m., at the Engineers' Club, Albert Square, Manchester 2; lecture on "The Reclamation of Engineering Components," by W. E. Ballard and J. W. Oswald. *Derby Automobile Division Centre.* January 16, at 7.30 p.m., at the Midland Hotel, Derby; lecture on "The Non-destructive Testing of Aero-engine Components," by W. G. Cook.

MANCHESTER ASSOCIATION OF ENGINEERS. January 13, at the Engineers' Club, Albert Square, Manchester; paper on "Engineering with Rubber," by D. H. Cooper, B.Sc. (Eng).

THE PLASTICS INSTITUTE. *South Wales and Monmouthshire Section.* January 11, at 7 p.m., at the Angel Hotel, Cardiff; lecture on "Injection Moulding," by G. Campbell, B.Sc.

ROYAL SOCIETY OF ARTS. January 11, at 6 p.m., at John Adam Street, Adelphi, London, W.C.2; paper on "Ergonomics—Fitting the Job to the Worker," by C. B. Frisby, Ph.D. Applications for tickets should be made to the secretary of the Society at the above address.

THE INSTITUTE OF METAL FINISHING. *North West Branch.* January 16 at 7.30 p.m., at the Ogden Arms Hotel, Sackville Street, Manchester; lecture on "Hard Chrome Plating," by J. Corfe. *London Branch.* January 16, at 6.15 p.m., at Northampton College of Technology, St. John Street, E.C.1; lecture on "Chromate Conversion Coatings on Aluminium," by W. Marchand.

British Warehouse Services, Ltd.

The British manufacturers of tools and hardware listed below have formed individual Canadian subsidiary companies or have established branches there, and have combined to form a jointly-owned warehousing and distribution company, British Warehouse Services, Ltd., with head office and central warehouse at 37 Six Points Road, Toronto, whence Mr. J. W. Willoughby, the vice-president, will direct operations. Taylor, Law & Cartwright, Ltd., are the Canadian sales agents for the companies concerned, which are as follows: Sheffield Twist Drill & Steel Co., Ltd.; Nuckey, Scott & Co., Ltd.; James Neill & Co. (Sheffield), Ltd.; Britool, Ltd.; Elliott-Lucas, Ltd.; Taylor, Law & Co., Ltd.; Joseph Thompson (Sheffield), Ltd.; and T. W. Young & Sons, Ltd.

Correction

In the advertisement of Herbert Widdowson & Sons, Ltd., Canal Street, Nottingham, which appears on p. 75 of this issue of MACHINERY, the prices for No. 2 and 3 Frema milling machines are given wrongly. The correct prices are as follows: No. 2, £1,745; No. 3, £1,925.

Personal

MR. D. L. BONNELL has been appointed sales representative in South Wales, Gloucestershire and Somerset for the Hymatic Engineering Co., Ltd., Redditch, Worcs.

MR. H. W. GATHERGOOD has been appointed a director of Waddells (Stratford Steel Equipment), Ltd., Millmarsh Lane, Brinsdown, Middlesex, a subsidiary of The Expert Tool & Case Hardening Co., Ltd.

MR. A. I. HELM, who has hitherto been plant engineer for the Skefko Ball Bearing Co., Ltd., Luton, has been appointed works manager of the company's proposed new factory at Irvine, Ayrshire.

MR. DOUGLAS BRADLEY, M.Sc. (Chem. Eng.), B.Sc., A.M.I.Chem.E., has been appointed technical manager of Sharples Centrifuges, Ltd., Tower Works, Doman Road, Camberley, Surrey.

MR. S. R. PARKER, senior lecturer at Enfield College, Middlesex, has been appointed head of the Engineering Department at Keighley Technical College, in succession to Mr. H. C. Town.

MR. A. NADIN, A.M.B.I.M., A.M.I.W.M., general manager of Brayshaw Furnaces, Ltd., and Brayshaw Tools, Ltd., Belle Vue Works, West Gorton, Manchester, 12, has been appointed a director of both companies.

MR. W. LATTA has been appointed director and general manager of Rhodes, Brydon & Youatt, Ltd., Reddish Engineering Works, Stockport, Cheshire, following the acquisition of that company by Crane, Ltd.

MR. L. GOSLAND, B.Sc. (Eng.), M.I.E.E., has been appointed deputy director, and Mr. C. G. Garton, M.I.E.E., F.Inst.P., and Mr. E. W. Golding, O.B.E., M.Sc.Tech., M.I.E.E., M.Am.I.E.E., assistant directors, of the Electrical Research Association, Thorncroft Manor, Leatherhead, Surrey.

MR. J. G. NOBLE, A.M.I.Mech.E., M.I.Prod.E., A.M.I.Struct.E., M.Inst.W., chief engineer for Snow & Co., Ltd., Stanley Street, Sheffield, 3, has been appointed a special director of the company, and now holds the position of works director.

MR. M. J. HILL, has resigned from the position of chairman and managing director of John Baker & Sons, Ltd., Monmouth Works, Malinda Street, Sheffield, 3, due to ill health. MR. A. H. M. GREENSTOCK, has been appointed sales director of the company.

MR. C. C. MILLER, B.Com., F.C.A., has been appointed by The Delta Metal Co., Ltd., as deputy chairman of Earle, Bourne & Co., Ltd., Heath Street South, Birmingham, producers of brass sheet and tubes and brass and copper strip.

MR. JACK JOHNSON, A.M.I.Mech.E., has been appointed home sales manager for Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, as from January 1. Mr. Johnson was formerly director and general manager of English Steel Tool Corporation, Ltd., and served his apprenticeship with Alfred Herbert, Ltd.

MR. J. P. HATFIELD, until recently a member of the board of Gate Machinery Co., Ltd., has joined Mr. C. H. Frye as managing director of Frye Machine Tool Co., Ltd. This company will deal mainly in second-hand machine tools. A showroom of nearly 10,000 sq. ft. at Poyle Road, Colnbrook, Slough (near London Airport), will be completed this month.

Mr. Hatfield has also been appointed to the board of The Times Machinery Co., Ltd., of the same address, importers and distributors of new machine tools.

MR. A. G. THORBURN, machine shop manager of Distington Engineering Co., Ltd., Workington, Cumberland, has been appointed quality control engineer responsible to the general manager for all matters of quality control and inspection. COMMANDER M. G. LYNE, quality control engineer, has become chief planning engineer responsible to the production manager (engineering) for planning, estimating, progress and shop loading, and ancillary departments. Mr. J. Lowe, assistant machine shop manager, has been appointed acting machine shop manager.

Built by Davy-United

A publication with this title has been issued by Davy and United Engineering Company Limited and it is explained in an addendum slip that it had gone to press before the completion of the merger between the former Davy-United and Power-Gas groups to form the Davy-Ashmore Group. The book is exceptionally well presented and of the large number of illustrations, many are in full colour. An introduction gives a general indication of the range of rolling mill engineering currently undertaken. Separate sections are then devoted to rolling mills for steel, rolling mills for non-ferrous metals, rolling mill auxiliaries, continuous processing lines, systems and services, instrumentation for rolling mills, railway wheel plant, and design and production capacity.

Preston Plating Jigs and Replaceable Wire Forms

In MACHINERY, 97/1305—7/12/60, an article was published under the title "Detachable Hooks and Clips for Plating Racks." It should have been stated in this connection that the various arrangements described are fully covered by patents held by John Preston & Co., Ltd., Sarsfield Road, Perivale, Middlesex, and we express our apologies for this omission.

The company offers a range of standard jigs, from stock, with various hole spacings and wire arrangements which are suitable for many forms of components. In addition special jigs can be designed and supplied where necessary. The shafts and hooks are of $\frac{3}{8}$-in. brass rod, and are insulated with Prestoncote.

In addition there is a range of standard wire forms which are available in 12, 13, and 15 gauge. These wires, also, provide for a wide variety of parts.

Obituary

MR. WILL ARCHDALE. We regret to announce the death of Mr. Will Archdale, director of James Archdale & Co., Ltd., Blackpole Works, Worcester, on December 17, at the age of 65.

Industrial Notes

OPPERMAN GEARS (HOLDINGS), LTD., Newbury, Berks., have purchased the business of W. J. Mariner & Co., Ltd., non-ferrous founders, Luton, Beds.

SANDVIK SWEDISH STEELS, LTD., Halesowen, Birmingham, have opened a new distribution depot at Blackbraes Road, Nerston Industrial Area, East Kilbride, near Glasgow.

SOLAR WELD LANGUEPIN, LTD., is the title of a new company which has been formed to market Languepin spark erosion machines in the United Kingdom and Commonwealth. The headquarters are at Burnley, Lancashire.

DAVIS & TIMMINS, LTD., Billet Road, Walthamstow, London, E.17, have established another new depot, on the Bridgend Trading Estate, to serve the industrial needs of South Wales.

G. A. HARVEY & CO., (LONDON), LTD., inform us that the address of their Sales Department is now Villiers House, Strand, London, W.C.2. Early next year the new London showrooms will be opened in the same building.

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous equipment will be held on February 14 and 15, at the W.D. Storage Depot, Royal Arsenal, Woolwich, London, S.E.18. The auctioneers will be Fuller, Horsey, Sons & Cassell (Dept. N), 10 Lloyds Avenue, London, E.C.3.

ELCONTROL, LTD., Wilbury Way, Hitchin, Herts., have prepared data sheet PSL issue 1, which describes the current design of Elcontrol PSL2 lighting controller for switching on and off electrical lighting in accordance with decrease or increase of intensity of daylight.

THE FEDERATION OF RUBBER AND ALLIED MANUFACTURERS, 43 Bedford Square, London, W.C.1, have issued a short "Guide to the Drafting of Specifications for Rubber Products." Copies may be obtained, free of charge, from the Secretary, at the above address.

COURTBURN POSITIONERS, LTD., have increased their range of welding platens to cover sizes from 4 ft. by 2 ft. by 4 in. to 10 ft. by 5 ft. by 6 in. They have also introduced two new platens of modified design which has enabled weight and cost to be reduced. The dimensions of these platens are 6 ft. by 3 ft. by 6 in. and 8 ft. by 4 ft. by 6 in.

SAFETY SERVICE CO., LTD., Itex House, Wendover Road, Harlesden, London, N.W.10, have introduced Itex Flexispecs with unbreakable nylon frame and replaceable, curved, shatterproof lenses. Clear nylon side shields are fitted and the Flexispecs, which weigh 1 oz., may be worn over ordinary spectacles.

ALLEN WEST & CO., LTD., Brighton, 7, will show examples of their electric motor control gear at the British Trade Fair which is to be held in Moscow next summer. Exhibits will include a PSC4D plug-in unit from the standard starter range, for general industrial use, also a number of flameproof units.

THE INSTITUTION OF MECHANICAL ENGINEERS, 1 Birdcage Walk, Westminster, London, S.W.1, on the recommendation of the Joint British Committee for Vacuum Science and Technology, are arranging for a symposium of papers on user experience of large-scale industrial vacuum plant to be held at the above address on March 1 and 2, next. The proceedings will include a group of papers on vacuum processing and treatment of metals, also papers on other metallurgical subjects.

MATTERSON, LTD., P.O. Box 31, Shawclough, Rochdale, announce that owing to the number of enquiries that they have received for the recently introduced electric screw-type jacks for lifting locomotives, they are extending the range to cover capacities from 7½ to 40 tons.

PYE INDUCTION HEATING COURSE.—In view of the response to announcements concerning forthcoming induction heating coarses, arrangements have been made for an additional course to be held at the Globe Hotel, Hills Road, Cambridge, on March 7 and 8. Full particulars can be obtained from Mrs. E. Raeburn, Pye Process Heating, 28 James Street, Cambridge.

LANG PNEUMATIC, LTD., Owen Road, Wolverhampton, have recently added to their extensive range of equipment a number of rotary valves intended particularly for use in the chemical industry. Such a valve may have a number of outlet ports depending on the size of the housing. For example, a valve with dimensions of 2 by 2 by 3 11/16 in. has one inlet, one exhaust, and six ⅛-in. diameter outlet ports.

PYRAMID INSTRUMENT CORPORATION, Sales Division, H. J. Baldwin & Co., Ltd., 221 Grand Buildings, Trafalgar Square, London, W.C.2, are arranging to issue a series of booklets to assist those concerned with the servicing of electrical circuits. The first booklet to be released is entitled "Trouble Shooting Motors with a Volt Ammeter." These booklets can be obtained from the above address.

CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks., are introducing a scheme for training suitable applicants for senior positions in administration and engineering. There will only be a few vacancies initially, but it is hoped that youths of 16-17, within a large radius of Hungerford, will make application for admission to the 4-year course. Full particulars can be obtained from the above address.

STEEL AND PIG IRON PRODUCTION. In November, for the first time, steel production averaged more than 500,000 tons per week. The actual figure of 504,500 tons exceeded the previous record average, achieved in October, by 7,500 tons. As compared with November, 1959, the increase was 46,000 tons per week.

Pig iron output in November, at 315,000 tons per week, also exceeded the previous record, set up in October.

DESIGN APPRECIATION COURSE. A third design appreciation course for apprentices and junior engineers is being organized by the Council of Industrial Design. It will be held at Reigate in March and April and there will be two residential periods, each of four days, separated by an individual study period of four weeks. The maximum number of students accepted will be 16, and the cost, exclusive of travelling, is £36 15s. Further information can be obtained from Miss Sydney Foott, Education Section, CoID, 28 Haymarket, London, S.W.1.

E.S.T. (GAUGES), LTD., Lammas Works, Godalming, Surrey, inform us that they have adopted a new method of applying and bonding a surface coating of tungsten carbide to gauges, arbors, and mandrels, for example, and

have developed a grinding technique which enables high surface finish and close dimensional accuracy to be obtained. Gauges treated by this process will be marketed under the name Tuffest. It is stated that the same process can be employed to provide a coating of nickel-chromium-boron or ceramic.

In addition to supplying coated gauges, the company will treat customers' components, such as shafts, plungers, spindles, and slides, to provide exceptional wear resistance. Any desired coating thickness can be provided and effectively bonded to the parent metal.

NICKEL CONSUMPTION.—Mr. Henry S. Wingate, chairman of the International Company of Canada, Ltd., stated recently that the estimated consumption of nickel in the free world in 1960 reached the record total of more than 500 million lb. Consumption in the United States and Canada was approximately the same as in 1959, but there was a substantial increase in Europe.

EVODE, LTD., Industrial Adhesives Division, Glover Street, Stafford, have introduced a new double-sided adhesive tape known as Twinstik. It comprises a thin tissue which is impregnated with a special pressure-sensitive adhesive, protected by a treated paper. The tape is available in widths up to 12 in. and can be applied to most surfaces to give a strong and durable bond. It is claimed that it has many applications in manufacture and assembly.

FIRTH CLEVELAND STEEL, LTD., with registered offices at Wentworth Street, Sheffield, has been formed by the Firth Cleveland Group. The company will operate from Holmes Mill, Rotherham, and its function will be to ensure that the customers of J. J. Habershon & Sons, Ltd., The Tenuous Steel Co., Ltd., and Firth Cleveland Steel Strip, Ltd., "reap the benefits of the potential of these three companies which are now operating in the closest touch with each other to provide a wide range of specialist steel strip."

MOVIECOL, 15, Cricklewood Broadway, London, N.W.2, have introduced the Movie-Rep portable projector for the use of salesmen. This unit, it is claimed, enables a variety of products to be shown effectively on a small screen which also forms the lid of the carrying case. It weighs 6¼ lb. and has dimensions of 12 by 13 by 4 in. Film of 16 mm. gauge, either in black and white or colour, may be projected in daylight, and slow motion effects may be obtained. It is stated, moreover, that single frames can be shown, if required, without danger of burning the film. The projector can also be used for lectures on such subjects as work study.

LABOUR COSTS IN SOME INDUSTRIAL COUNTRIES.—In their "Management Commentary No. 5," the F. R. Bentley Co., 128 Mount Street, Berkeley Square, London, W.1, quote the following figures for labour costs in different industrial countries. These figures, it is stated, were obtained as a result of a survey for 1959 carried out by the French Institute of Statistical and Economic Studies. After each total figure, the portion accounted for by social charges is given in parentheses: U.S.A., 19s. 2d. (3s. 3d.); Sweden, 7s. 6d. (10d.); United Kingdom, 5s. 7d. (8d.); Switzerland, 5s. 7d. (8d.); West Germany, 5s. 6d. (1s. 8d.); Belgium, 6s. 4d. (1s. 4d.); France, 5s. 1d. (1s. 8d.); Italy, 4s. 5d. (1s. 11d.); and Holland, 4s. 2d. (1s.).

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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4/1/61

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Machine Tool Share Market

Seasonal influences made themselves felt in stock markets during the period under review. Business in most sections dwindled to small proportions, and prices generally moved only within narrow limits.

Little interest developed in the gilt-edged market, and for the most part undated British Government stocks tended to sag. Dated issues, however, together with Home Corporation and Dominion loans, remained quietly steady.

Commercial and industrial share markets maintained a firm tone, and while movements among prices were small and irregular, the trend in the main was towards higher levels, and a few features developed as a result of good company news.

Among machine tool issues Edgar Allen advanced 9d. to 36s. 6d.; Chas. Churchill, 3d. to 7s. 1½d.; Geo Cohen, 6d. to 12s. 3d.; Coventry Gauge & Tool, 1½d. to 23s.; Expert Tool, 6d. to 2s.; John Harper, 1½d. to 8s. 6d.; Kerry's (Gt. Britain), 3d. to 8s. 3d.; Tap & Die Corporation, 6d. to 13s. 6d.; and Thos. W. Ward, 1s. to 65s. On the other hand, Abwood Machine Tool lost 3d. at 1s. 3d.; British Oxygen, 1s. at 25s. 6d.; Samuel Osborn, 3d. at 42s. 9d.; F. Pratt, 2s. at 14s. 9d.; Ambrose Shardlow, 6d. at 44s. 9d.; and Sheffield Twist Drill, 3d. at 15s. 3d.

BRITISH OXYGEN CO., LTD.—Final dividend 10 per cent, making, with the interim, a total distribution of 16 per cent for the year to September 30.

Trade Publications

ADAPTA-CHARTS, LTD., 129 Hammersmith Road, London, W.14. Brochure showing typical applications of the company's Movigraph wall charts for a variety of purposes in different industries.

ROCKWELL MACHINE TOOL CO., LTD., Welsh Harp, Edgware Road, London, N.W.2. Well-presented and illustrated brochure devoted to the size ID and 2 knee type milling machines built by Fritz Werner A.G., Berlin-Marienfelde. These machines are available in horizontal, vertical, and universal forms and have table sizes of 43 by 12 in. and 53 by 12 in. The operating controls are clearly explained with the aid of a coloured diagram, and sections are devoted to standard and special equipment. A second brochure, which is also notable for the quality of the illustrations, is concerned with practical applications of Fritz Werner programme controlled milling machines.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	36/6
" " "	5% Prf.	£1	14/6*
Arnott & Harrison, Ltd.	Ord.	4/-	12/3
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	11/9
" " "	6% Cum. Prf.	£1	18/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	75/6
" " "	5% Cum. "A" Prf.	£1	14/6
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% 1st Mort. Deb.	Stk.	90½
British Oxygen Co., Ltd.	Ord.	5/-	25/6
" " "	6½% Cum. Prf.	£1	20/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/6
Broom & Wade, Ltd.	Ord.	5/-	22/3
" " "	6% Cum. Prf.	£1	18/9
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	18/3
Butler Machine Tool Co., Ltd.	Ord.	5/-	17/6
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	7/1½
" " "	6% Cum. Prf.	£1	25/9†
Churchill Machine Tool Co., Ltd.	Ord.	5/-	38/10½
" " "	6% Cum. Prf.	£1	18/-
Clarkson (Engrs.), Ltd.	Ord.	5/-	26/3
Cohen (George), 600 Group, Ltd.	Ord.	5/-	12/3
" " "	4½% Cum.Prf.	£1	13/9
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	23/-
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/9
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/7½
" " "	4½% Red. Cum. Prf.	£1	13/-xd
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/6
Greenwood & Batley, Ltd.	Ord.	£1	115/-
Harper (John) & Co., Ltd.	Ord.	5/-	8/6
" " "	4½% Red. Cum. Prf.	£1	12/7½
Herbert (Alfred), Ltd.	Ord.	£1	51/3
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	13/9
" " "	"B" Ord.	5/-	13/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	31/3
" " "	7% Cum. Prf.	5/-	5/-
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	17/6
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	8/3
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/9
Massey, B. & S., Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	5/6
Newman Industries, Ltd.	Ord.	2/-	5/3
" " "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	4/-
Norton W. E. (Holdings) Ltd.	Ord.	2/-	3/3
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	42/9
" " "	5½% Cum. Prf.	£1	25/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	14/9
Sanderson Kayser, Ltd.	Ord.	10/-	34/4½
" " "	6½% Cum. Prf.	£1	18/-
Scottish Machine Tool Corporation Ltd.	Ord.	4/-	10/-
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	44/9
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	15/9
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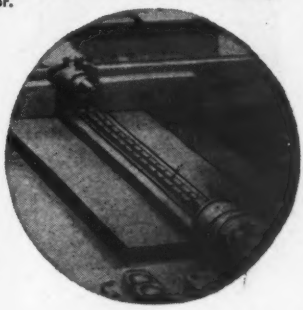

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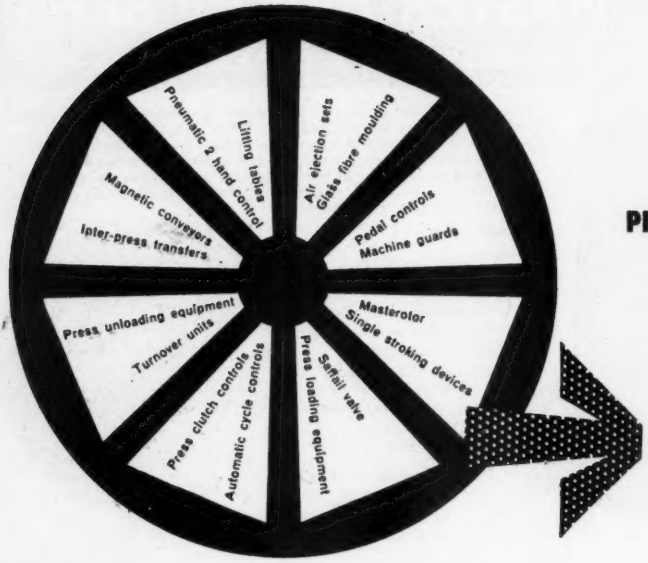

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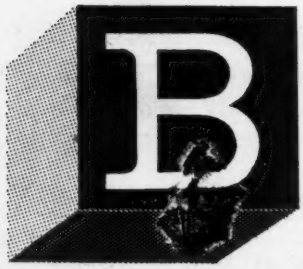

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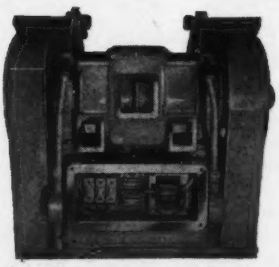
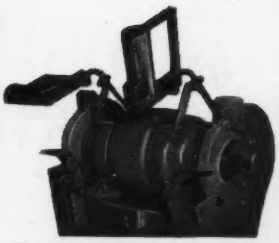


Control switchgear is designed into the machine and not added as an afterthought.



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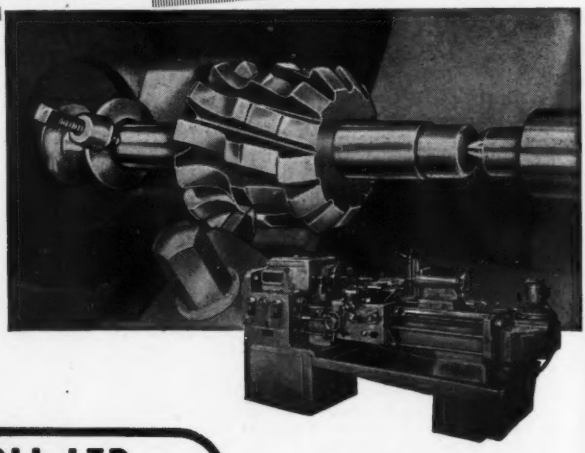

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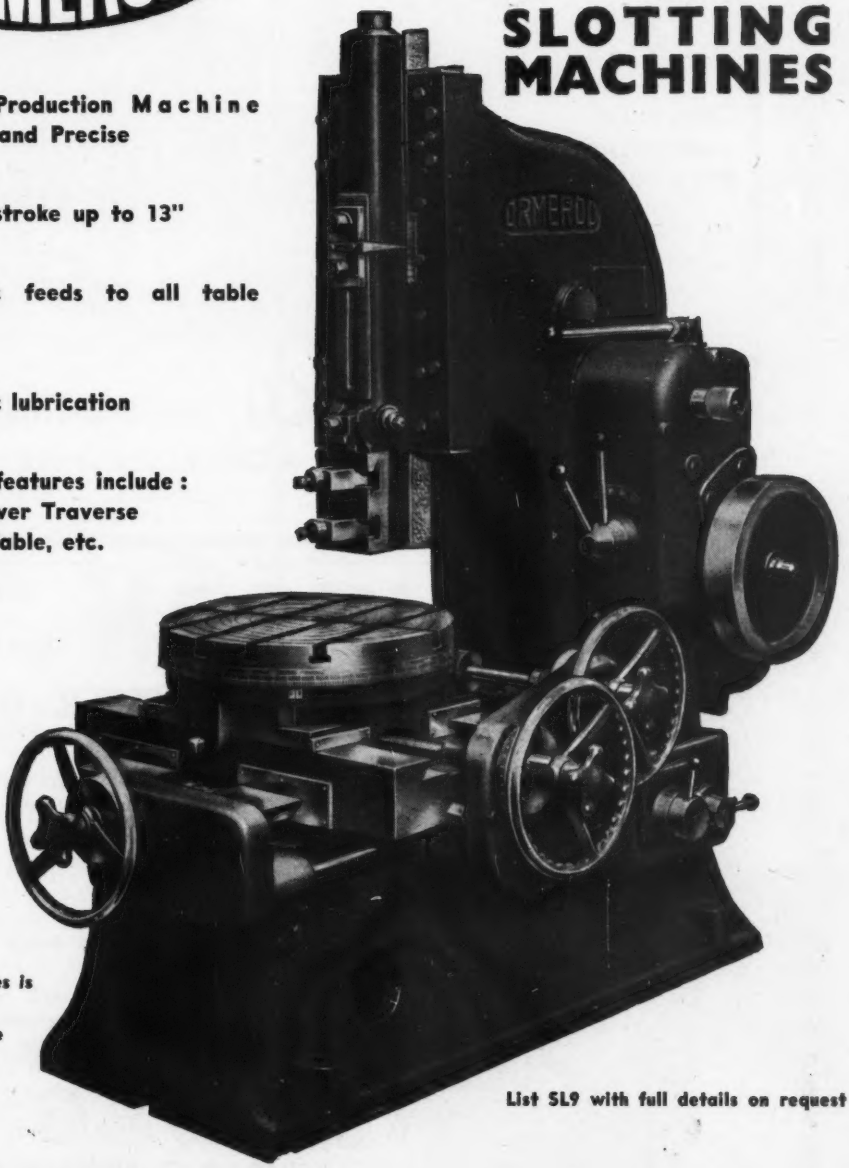

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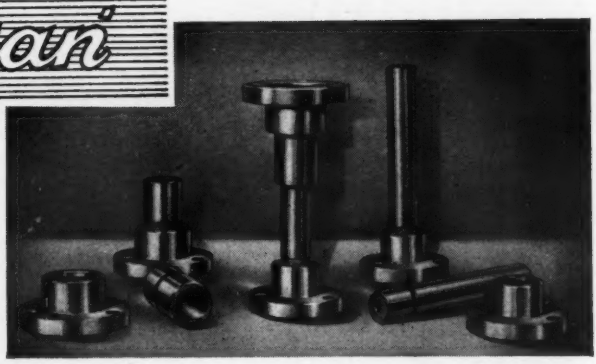

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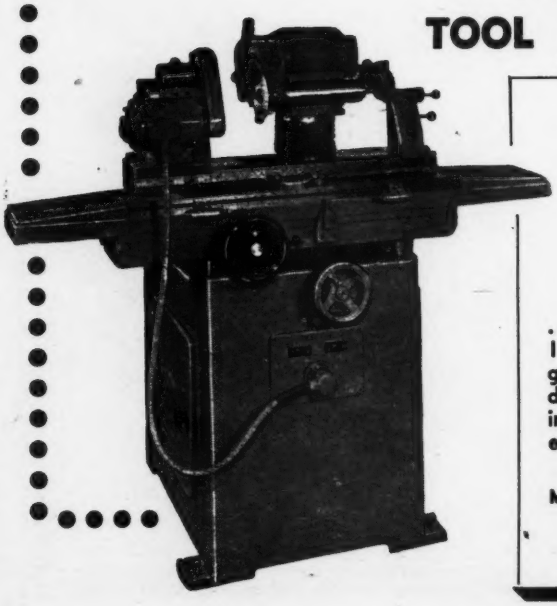

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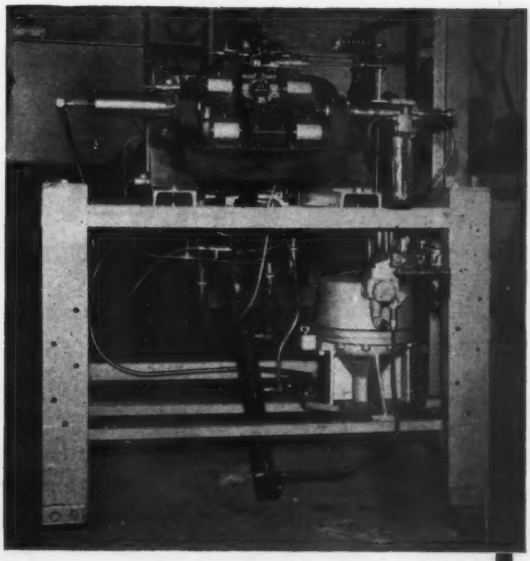

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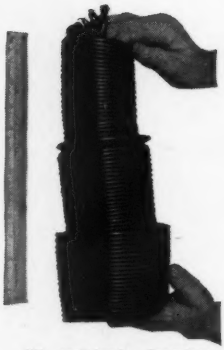

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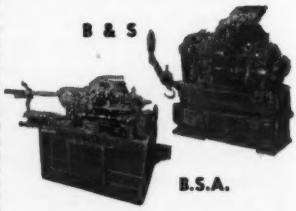

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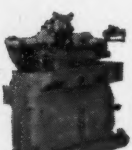

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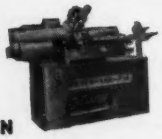

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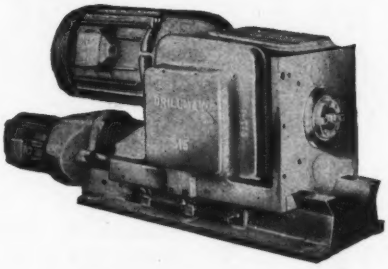

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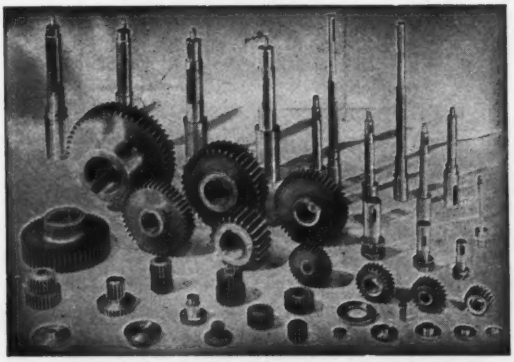

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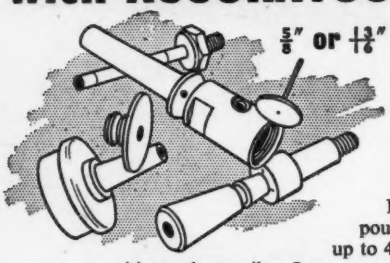

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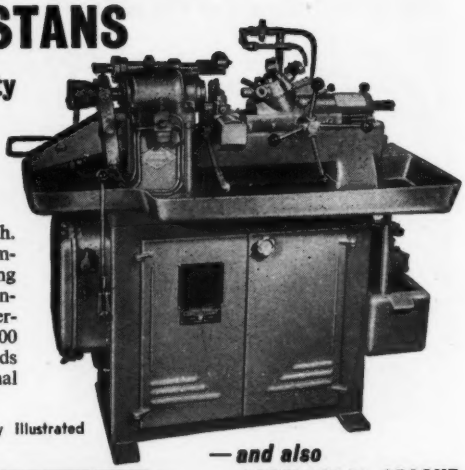

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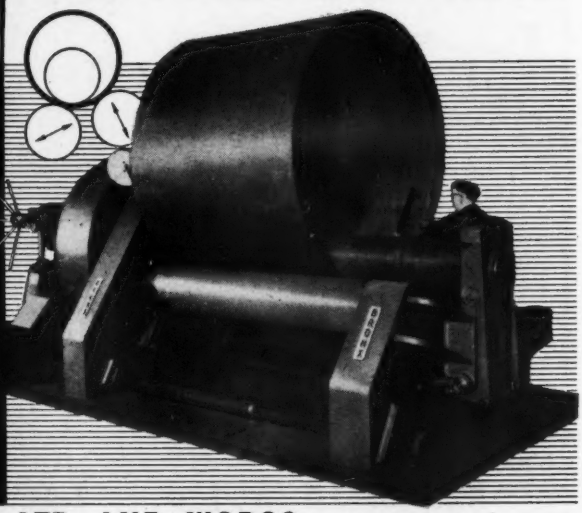

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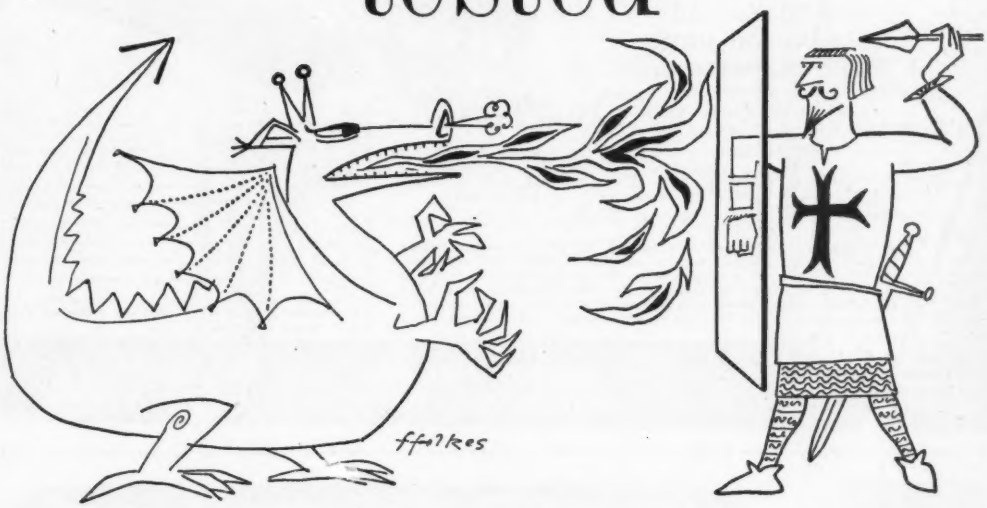

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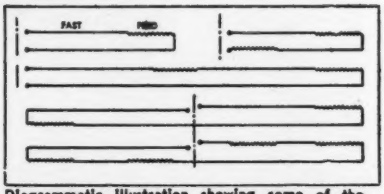
	Model 0	Model 1	Model 2
Travel	0"-5"	0"-6"	0" x 12"
Work Table	12" x 4½"	18" x 6½"	26" x 9½"
Approx. thrust	180 lb.	400 lb.	800 lb.

GIVES HIGHER PRODUCTION ON MILLING, DRILLING, TAPPING AND BORING MACHINES

Recommended air line pressure: 70/100 lb. per sq. in.

Feed rates are infinitely variable from 1in. per min. upwards on 0 and 1 Models, and ½in. per min. on Model 2. Special tables with feed rates down to ¼in. per min. are made for heavier work. The production Unit cylinder is cushioned on return stroke. Work Transfer Units have cushioned cylinders working against adjustable dead stops, stationing one component under the tool whilst another is being loaded.



Diagrammatic illustration showing some of the many cycles available.

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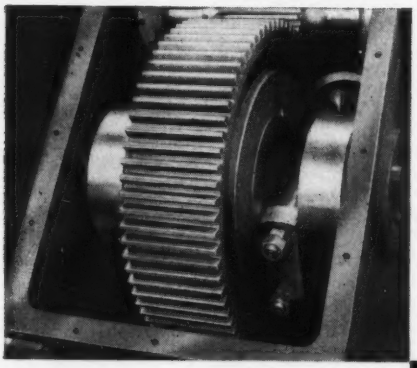

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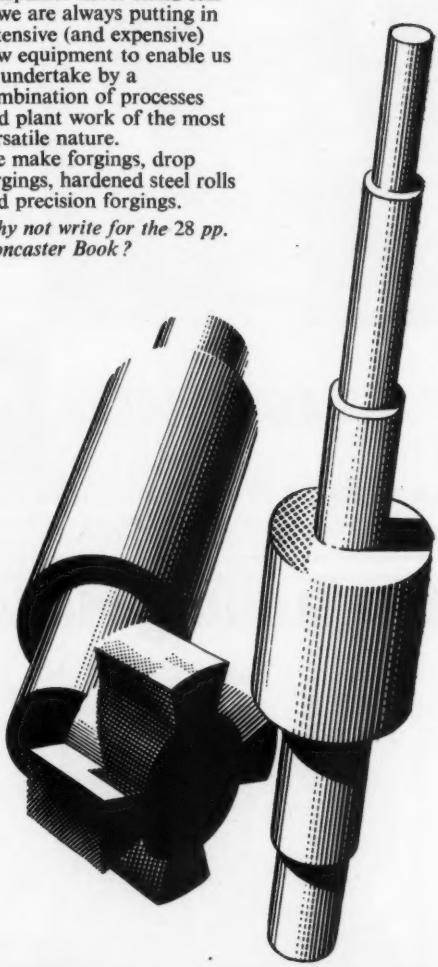

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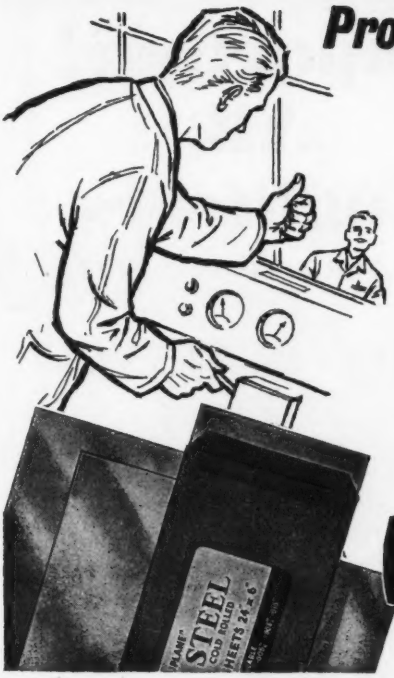

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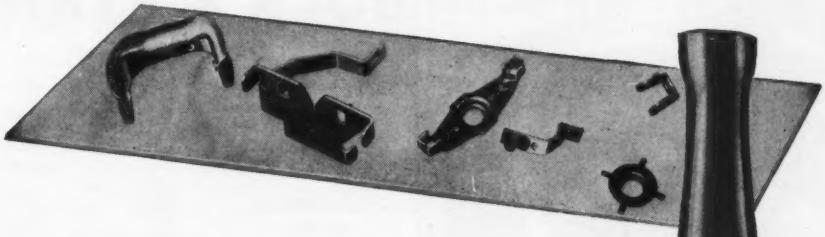

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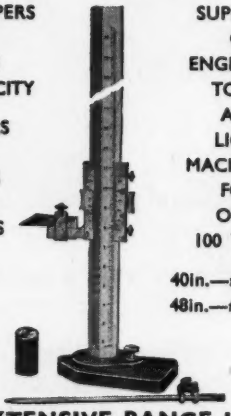

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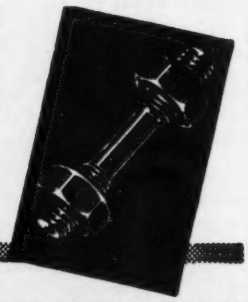

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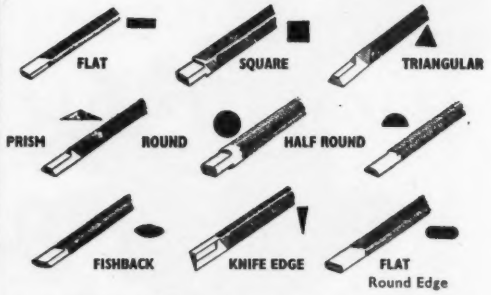

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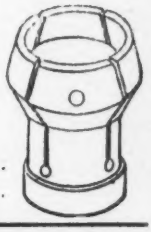

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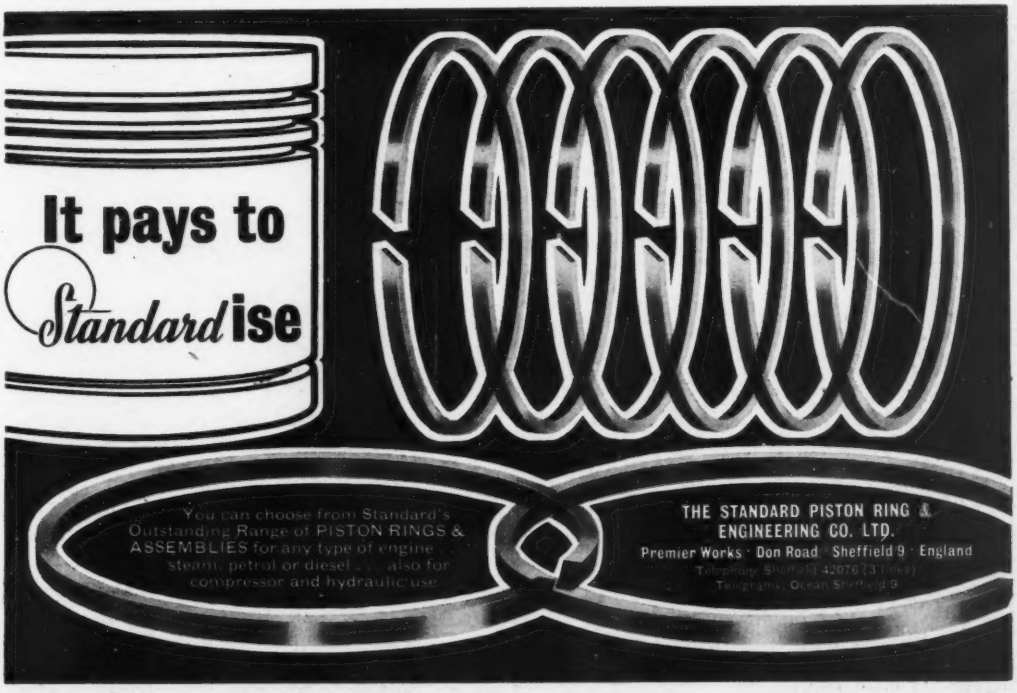
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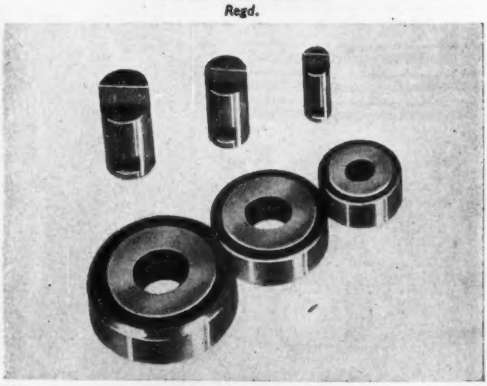

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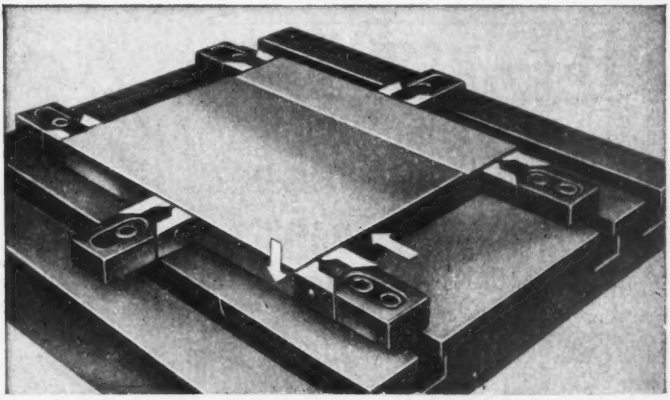

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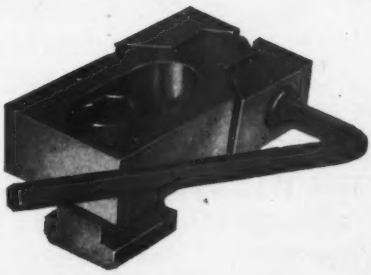
2	60/1	3 5 3	60/2	3 11 0	3¾	2	1	⅝	2
3	61/1	4 14 6	61/2	5 2 0	5¼	3½	1 3/16	¾	3½



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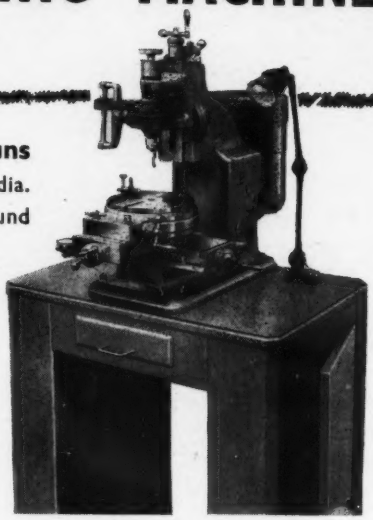

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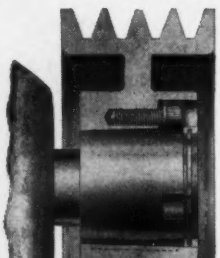

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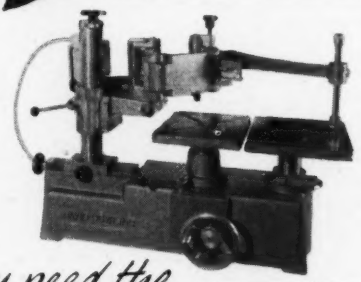

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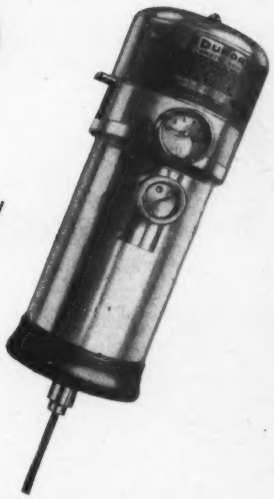

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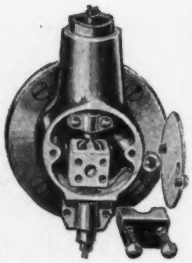

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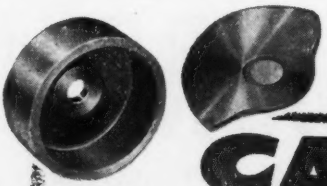

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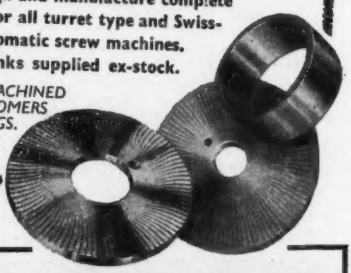

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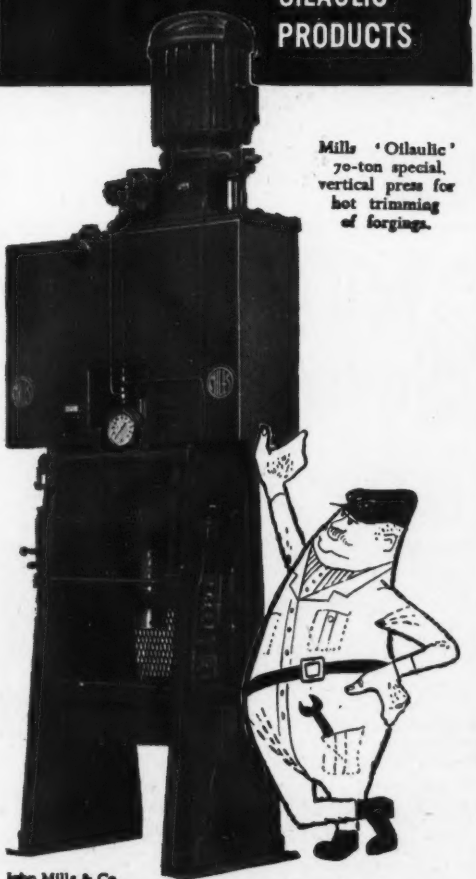

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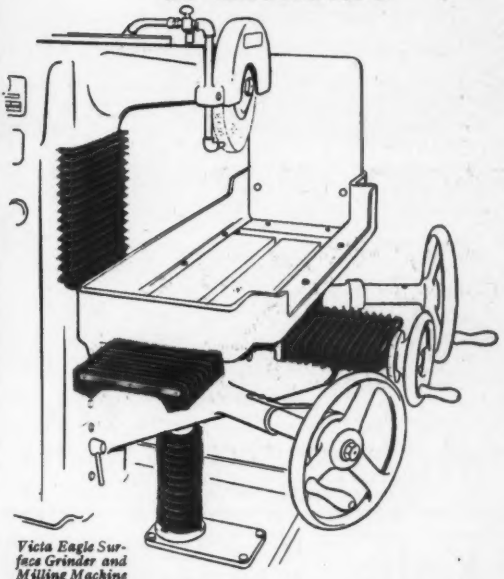

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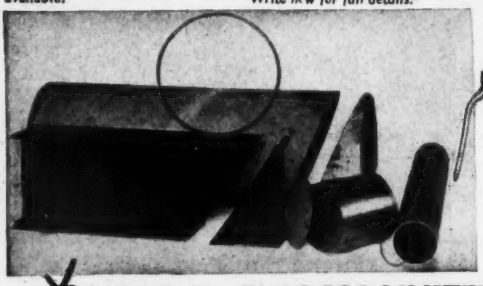

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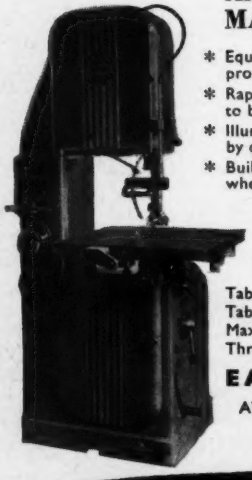

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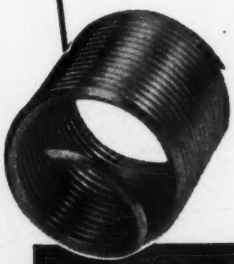

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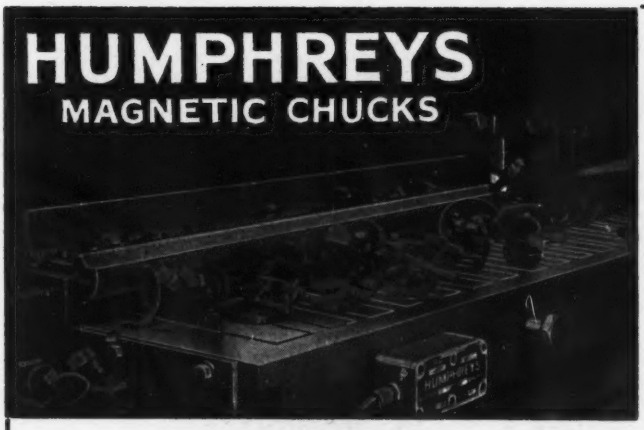

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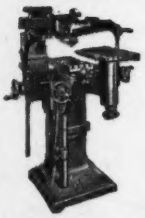

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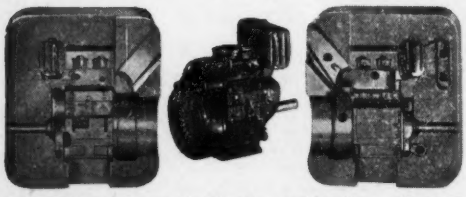

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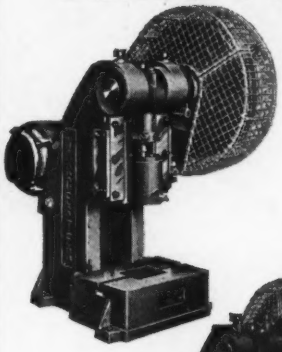
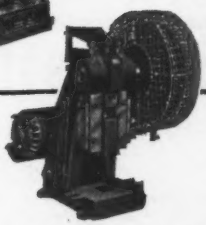


6 TON

3 TON



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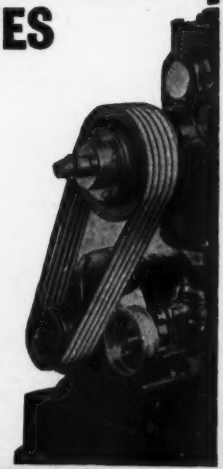

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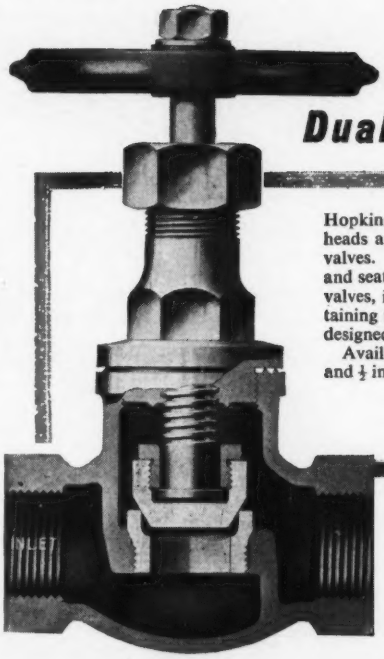

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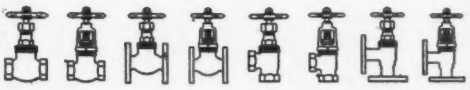

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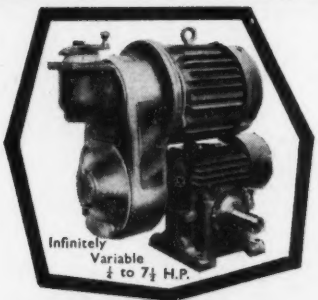

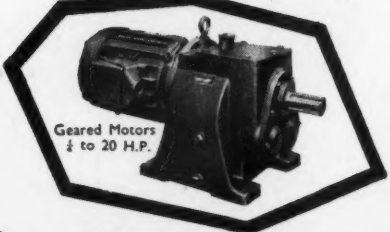

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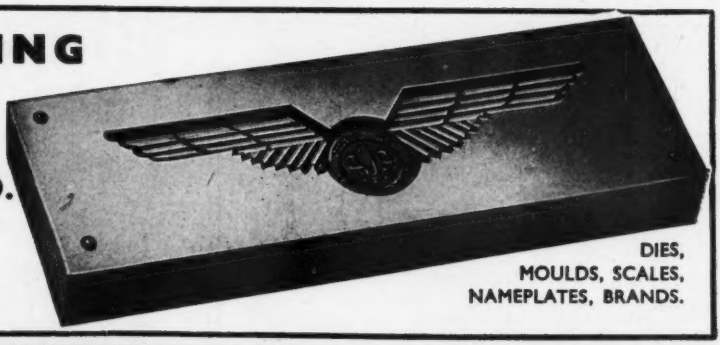

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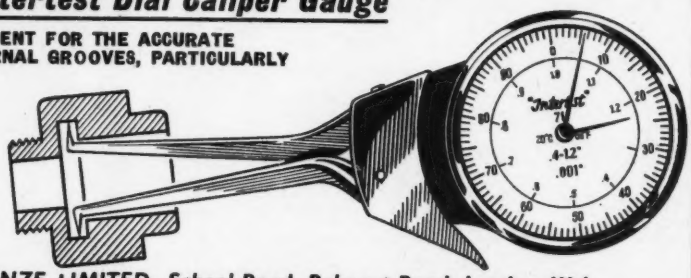
72	·8"-1·6"
73	1·2"-2·0"
74	1·6"-2·4"
75	2·0"-2·8"
76	2·4"-3·2"



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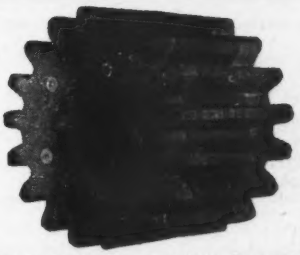

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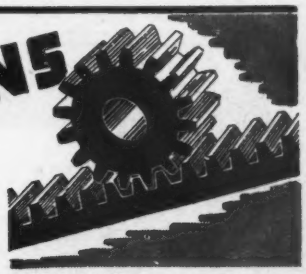

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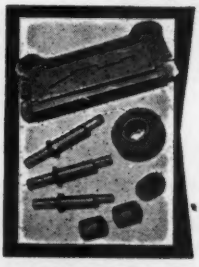

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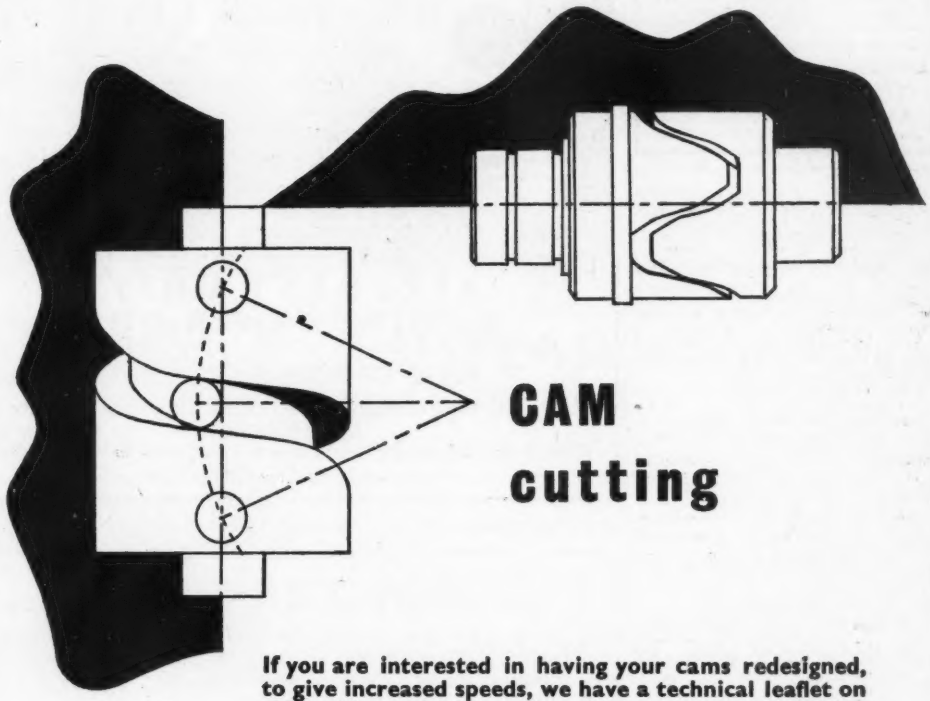

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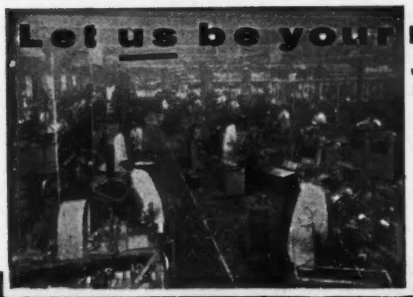

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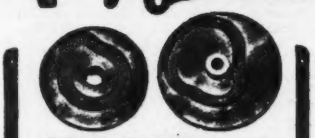

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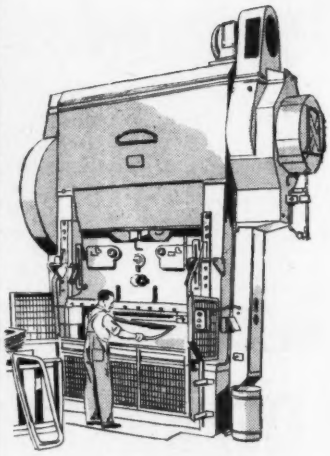

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LANG 36in. Surfacing and Boring.
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RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor S.S. & S.C.
WILLSON 6½in. × 36in. Gap Bed S.S. & S.C.
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PULTRA Model 10 Watchmakers' Lathe.

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CORONA Model 12AX Bench, ⅝in. cap.
BRISDON Model 52 Pillar, ½in. cap.

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BROWN & SHARPE No. 23 Plain, cap. 10in. × 48in.
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REED PRENTICE Mod. 3VG., Table 38in. × 10½in.
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KENDALL & GENT Duplex Profile, table 18in. × 15in.

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ADCOCK & SHIPLEY No. 1AB Plain, table 26in. × 7in.
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ARCHDALE 14in. Plain, table 27in. × 8in.
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HUNT No. 3 Twist Drill Grinder, 3in. cap.
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JUNG 18in. × 6in. Hydraulic Horizontal Surface Grinder.
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STARTRITE MEBA 10in. Horizontal Bandsaw. £225

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KERRY Super 8 Bench Drill.
INVICTA 1M Shaper.
PILOT 12 ton Hydraulic Press.
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CARDIFF 11in. × 80in. Gap Bed S.S. & S.C. Lathe.

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BUFFALO 28U Double Ended Punch, Shear and Angle Cropper.
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SOUTHBEND 16in.
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Variable Speed, Individual Drive Units, column type (H. Gear), ratio variable, 3 h.p., 400/3/50. 1,425 r.p.m. Checked over, and in good running order. Several available at £95 each.—ROLLS TOOLS, LTD., No. 1 Factory, Pyrford Road, Pyrford, Woking, Surrey. 'Phone: Byfleet 43252.

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GISHOLT No. 4 Capstan Lathe, chucking, 400/3/50.

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HAGO H.G.25 High Efficiency, ¾in. cap. £250.
THIEL ¾in. Radial Arm Tapper. £150.

GRINDERS

NORTON Uni. Hyd. Cyl. 48in. × 13in.
ABWOOD Vert. Sp. Surface, 18in. × 6in. £225.
NORTON 18in. × 7in. Hyd. Cyl. Grinder. £395.

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MURAD 3Q ¾ Capstan, collets and tooling. £225.
HOGARTH 6in. × 32in. S. & S. Lathe. £125.
SOUTHBEND 6¾in. × 36in. QCGB. £95.
PITTLER Turret Lathe, 2¼in. cap. £95.
SMART & BROWN SABEL 4¼in. × 18in. £150.
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SPRINGFIELD 34in. Swing F. & B. Lathe. £450.
SPRINGFIELD 14in. Swing F. & B. Lathe. £225

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VICTORIA U1 34 × 8¼, with div. heads. £325.
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HARDINGE 24in. × 6in. Prec. Auto feed. £165.
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MISCELLANEOUS

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BUTLER 4ft. Double Column Vertical Borer, motor drive, speeds to 44 r.p.m.
SELLARS 5in. Horizontal Boring Machine, cross traverse of table 60in.

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BUTLER 8in. Precision Slotter. 400/3/50.
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One **NEWALL** 'LA' 12in. × 36in. Grinder.

One **KEIGHLEY** 'XL' 6 by 18 Hydraulic Plain Grinder.

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One **NEWALL** No. 0 Jig Borer, fully rebuilt and carrying maker's guarantees.

Capacity: 18in. by 12in. Table 14in. Spindle Nose to top of table

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EMTOC MINIATURE Jig Boring Machine. (New machine under power in our showrooms.)

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WOLTERS Model IL Hydraulic Internal Lapping Machine.
DELAPENA Model HHM/1A Precision Honing Machine. (New.)
MOPCO 12in. by 30in. Cylindrical.
MOPCO 12in. by 48in. Cylindrical.
COVEL Tool and Cutter Grinding Machine.
NEWALL Angle Head Grinder. 10in. by 18in.
MATRIX No. 16 Plain Straight Grinder.
MATRIX No. 10 Universal Thread Grinder. 10in. by 36in.
MATRIX No. 6 Universal Thread Grinder. 3in. by 10in.
HEALD No. 81 Internal Grinder.
BROWN & SHARPE No. 2 Horizontal Surface Grinder. 18in. by 6in.

MILLING MACHINES
Vertical
VICTORIA Model V3 Vertical Mill.
HERBERT Model 15S Vertical Milling Machine. 45in. by 10in. table.
FRITZ WERNER No. 3230 Precision Vertical Milling Machine, 24in. by 8in. table. Longitudinal and cross power feed to table.
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VICTORIA Duplomatic Hydraulic Die Sinking machine (almost new).

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ADCOCK & SHIPLEY Model 1 with auto cycle.
ADCOCK & SHIPLEY Model 2b Plain Horizontal Milling Machine. (Unused.)
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Four **DENBIGH** Model No. C4 Horizontal Milling Machines.
VICTORIA Model U2 Universal Milling Machine.
CINCINNATI 18in. Mfg. Mill.
VICTORIA Junior Mill. (New.)
CINCINNATI Model 4/36 Hydromatic Milling machine (Simplex).

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SMART & BROWN Model M 4in. Precision Tool Lathe.
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LUMSDEN Double Ended Grinder. Wheels 24in. dia. × 4in. wide.

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HENDEY 9in. S.S. & S.C. Lathe. 12 speeds 14-478 r.p.m. Taper turning 4ft. 6in. between centres.

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WANDERER Heavy Duty Vertical Miller. Table 65in. × 13¼in. Speeds to 800 r.p.m. Swivel head. Power and quick power.

PLANING MACHINES

BOEHRINGER 10ft. Openside Planing Machine, 1 toolbox on cross rail, 1 sidebox. Electric drive and reversing.

PRESSES

BRADLEY & TURTON No. 3 Flypress.

SWEENEY & BLOCKSIDGE Bench Press. Capacity 3 tons.

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THIEL Bandsaw, with brar. attachment

SHAPING MACHINES

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Edwards

BESCO Model EB6 Eccentric Power Punching Press. Motorised 400-440/3/50 supply. Pressure exerted approx. 70 tons. Stroke adjustable from ⅛in. to 3½in. Table 26in. × 19in. Hole in table 11½in. × 9in. Weight approx. 50 cwt.

TWO NEW **LEN100/320** Open Fronted Inclinable Power Presses. Motorised for 400-440/3/50 supply. Pressure exerted 100 tons. Depth of throat 12½in. Adjustment of stroke ½in. to 5½in. Table 23½in. × 35⅞in. Hole in table 13½in. diameter. Weight approx. 147 cwt.

BESCO High Duty Double Geared Guillotine Shearing Machine. Motorised for 400-440/3/50 supply. Capacity 72in. × ½in. mild steel plate. With automatic hold-down and front, back and side gauges. Complete with one spare pair of blades. Weight approx. 12½ tons.

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BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

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WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PET Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.
ASQUITH Horizontal Floor Boring Machine, 7in. diameter travelling spindle.
GIDDINGS & LEWIS No. 45 Horizontal Boring Machine, 5in. diameter travelling spindle.

CAPSTAN AND CENTRE LATHES

HERBERT No. 12 Combination Turret Lathe, 6⅛in. diameter hollow spindle.
MILES Heavy Duty Centre Lathe, S.S. & S.C. 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

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HETTNER Radial Drilling Machine, 10ft. elevating arm.
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TOWN 30in. Single Spindle Boring and Drilling Machine.

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ORCUTT Model HM.24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

LANDIS Plain Hydraulic Cylindrical Grinding Machine, 18in. swing by 72in. between centres.
ORCUTT Model HM.24 Internal Spur Gear Grinding Machine.
CHURCHILL Crankshaft Grinding Machine 26in. swing × 84in. between centres.
CHURCHILL Turret Type Hydraulic Universal Grinding Machine, 16in. swing × 50in. between centres.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.
B.S.A. LANDIS Plain Cylindrical Grinding Machine, 6in. swing × 30in. between centres.
T.O.S. Vertical Spindle Hydraulic Surface Grinding Machine, table working surface 118in. × 24in. (NEW.)

MILLING MACHINES

CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial type Horizontal Milling Machine.
GRAFFENSTADEN Model FIL101 Plain Horizontal Milling Machine, table 52in. × 10in.
TECHNOIMPEX Universal Horizontal Milling Machine, table 59in. × 16in. (NEW.)
SUNDSTRAND Hydroscrew Rigid Mill Horizontal Production Milling Machine, table 78in. × 14in.
PRATT & WHITNEY Model BL.3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

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New GRAFFENSTADEN AF075 Horizontal Borer. 3in. spindle. 17½in. faceplate.

BROACH

FORST RIA5 Universal Vertical Broach for internal and surface broaching, 5 tons, 39½in. stroke.

RADIAL DRILL

CERUTI Type TNC 60 5ft. 8in. Heavy Duty Radial. 1952 machine.

GRINDERS

BROWN & SHARPE No. 2 Surface.
GRAND RAPIDS No. 36 24in. × 10in. Hydraulic Surface.
LANDIS 10in. × 18in. Plain Grinder.
CHURCHILL 10in. × 24in. Universal.
LANDIS 12 × 48 Universal.
BROWN & SHARPE No. 3 Universal.
NORTON 14in. × 36in. Universal.
CHURCHILL HBA Auto-Sizing Internal.
ROWLAND Three Wheel Carbide Tool Grinder and Lapper.
NEWALL 10U Universal Lapper.

TURRET LATHES

GISHOLT IL Turret Lathe.
FOSTER No. 2B Turret Lathe.

CENTRE LATHES

DENHAM DF4 4½in.
LODGE & SHIPLEY 12in. Swing.
WILLSON 7½in. Newel.
ROLLO SUPREME 7½in.
WARD, HAGGAS & SMITH 8½in. Gap Bed, 36in. between centres.
CROMWELL 3½in. Precision.

MILLERS

KENT OWENS 1-8 and 1-14 Horz. Hydraulic.
SUNDSTRAND No. 0 Rigidmill.
ARCHDALE 14in. Horizontal.
GRAFFENSTADEN FH121 Plain Horizontal with Universal Vertical Head. Table size 59in. × 13½in.
MATTERSON No. 1 Thread.
REIDEN No. 2 Vertical. 1953 machine.
HERBERT 23V Vert. Table 68in. × 17in. 48in. traverse.
REED PRENTICE No. 6 Heavy Duty Vert. Table 84in. × 20in. 72in. traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).
MOREY 12M Duplex Profiler.
ASQUITH HKO Duplex Keyseater.

PRESS

V & O No. 11 Double Action. Approx. 10 tons. Roll feed. Max. draw 1in.

All machines motorised 400/3/50 unless otherwise stated.

Edwards' Besco' Bedding Rolls, capacity 6ft. 0in. × ¼in. Full motorised. Excellent condition.

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Loewe Boring and Facing Lathe, high speed machine, 475 to 3,000 r.p.m. Swing 16in. Multi-speed motor, 400/3/50.—BOX C422, MACHINERY, Clifton House, Euston Road, N.W.1.

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BULLARD 16in. SPINDLE MULT-AU-MATIC,

completely rebuilt and in excellent condition. Complete with equipment, 12in. raised column, has power chucking, but is less chucks.

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ARCHDALE 4ft. Radial Drilling Machine complete with box table.

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Ward 2A. Feed to saddle.
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Many other machines in stock.
All motorised 440/3/50.

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N.A.T.O. COMMON INFRASTRUCTURE
SLICE VI
NAVAL BASE INSTALLATIONS

FINAL NOTICE is Hereby given that International Competitive Bids will be invited on or about the 31st March, 1961, for the supply, installation and setting to work at a Depot on the West Coast of Scotland, of

One in number **OIL FIRED DESTRUCTOR FURNACE.**

2 The approximate cost of the contract is £1,200.

3 The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the Main Contract for the construction of the Depot.

4 It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the Contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5 The closing date for the receipt of bids will be 1st May, 1961.

6 Firms wishing to bid must formally notify their desire by application to the address below by 31st January, 1961.

7 Enquiries regarding bidding should be addressed to:—

DIRECTOR GENERAL, Navy Works,
Admiralty,
Chamberlain Way,
Pinner,
Middlesex, England,

quoting reference N.A.T.O. C.I. Job No. 3 (Sub-Contract Destructor Furnace).

N.A.T.O. COMMON INFRASTRUCTURE
SLICE VI
NAVAL BASE INSTALLATIONS

FINAL NOTICE is Hereby given that International Competitive Bids will be invited on or about the 31st March, 1961, for the supply, installation and setting to work at a Depot on the West Coast of Scotland, of

Two in number **MOTOR DRIVEN FIRE PUMPS,** each capable of delivering 500 gallons per minute at 150 p.s.

2 The approximate cost of th contract is £3,400.

3 The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the Main Contract for the construction of the Depot.

4 It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the Contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5 The closing date for the receipt of bids will be 1st May, 1961.

6 Firms wishing to bid must formally notify their desire by application to the address below by 31st January, 1961.

7 Enquiries regarding bidding should be addressed to:—

DIRECTOR GENERAL, Navy Works,
Admiralty,
Chamberlain Way,
Pinner,
Middlesex, England,

quoting reference N.A.T.O. C.I. Job No. 3 (Sub-Contract Fire Pumps).

N.A.T.O. COMMON INFRASTRUCTURE
SLICE VI
NAVAL BASE INSTALLATIONS

FINAL NOTICE is Hereby given that International Competitive Bids will be invited on or about the 31st March, 1961, for the supply, installation and setting to work at a Depot on the West Coast of Scotland, of

One in number **DUST EXTRACTION PLANT AND CYCLONE** for a Joiners' Shop.

2 The approximate cost of the contract is £560.

3 The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the Main Contract for the construction of the Depot.

4 It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the Contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5 The closing date for the receipt of bids will be 1st May, 1961.

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Admiralty,
Chamberlain Way,
Pinner,
Middlesex, England,

quoting reference N.A.T.O. C.I. Job No. 3 (Sub-Contract Dust Extraction Plant).

N.A.T.O. COMMON INFRASTRUCTURE
SLICE VI
NAVAL BASE INSTALLATIONS

FINAL NOTICE is Hereby given that International Competitive Bids will be invited on or about the 31st March, 1961, for the supply, installation and setting to work at a Depot on the West Coast of Scotland, of

Three in number **ROADSIDE METERING PUMPS** (one Petrol and two Diesel)

2 The approximate cost of the contract is £740.

3 The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the Main Contract for the construction of the Depot.

4 It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the Contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5 The closing date for the receipt of bids will be 1st May, 1961.

6 Firms wishing to bid must formally notify their desire by application to the address below by 31st January, 1961.

7 Enquiries regarding bidding should be addressed to:—

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Chamberlain Way,
Pinner
Middlesex, England,

quoting reference N.A.T.O. C.I. Job No. 3 (Sub-Contract Metering Pumps).

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Le Blond Regal 19in. × 48in. All-geared Lathe. Mot. Switchgear. Norton box, equipment. Ex. cond.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

One Geisler Dynamic Balancing Machine. Model G, 1939. Offers to BOX C553, MACHINERY, Clifton House, Euston Road, N.W.1.

Precimax Cylindrical Grinder, model MPO.5 × 18in. between centres. Fully motorised. 1945 machine.—BOX C495, MACHINERY, Clifton House, Euston Road, N.W.1.

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Churchill-Redman 12in. × 40in. Semi-Automatic Hydraulic Profiling Lathe. Hydraulic chuck and tailstock. Front profiling slide, rear facing slide, 15 h.p., two-speed motor. Post-war machine. Excellent condition. —LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

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Dean, Smith & Grace 10in. × 40in. between Centres S.S. & S.C. Lathe Serial No. 23202. Built-in flange type motor Completely rebuilt.

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Footburt Automatic Lathe, 1¼in. bar capacity. Condition good. Seen London area.—BOX C431, MACHINERY, Clifton House, Euston Road, N.W.1.

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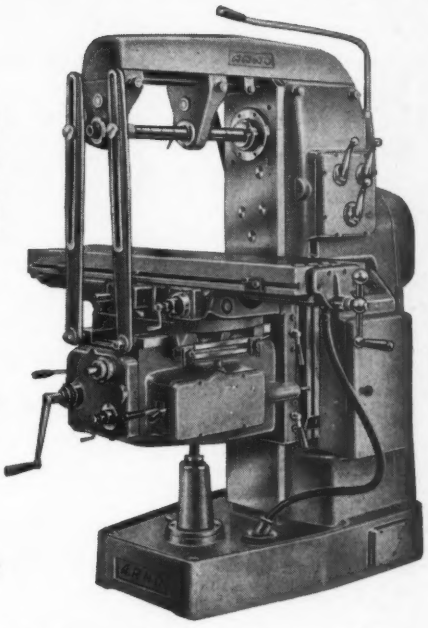

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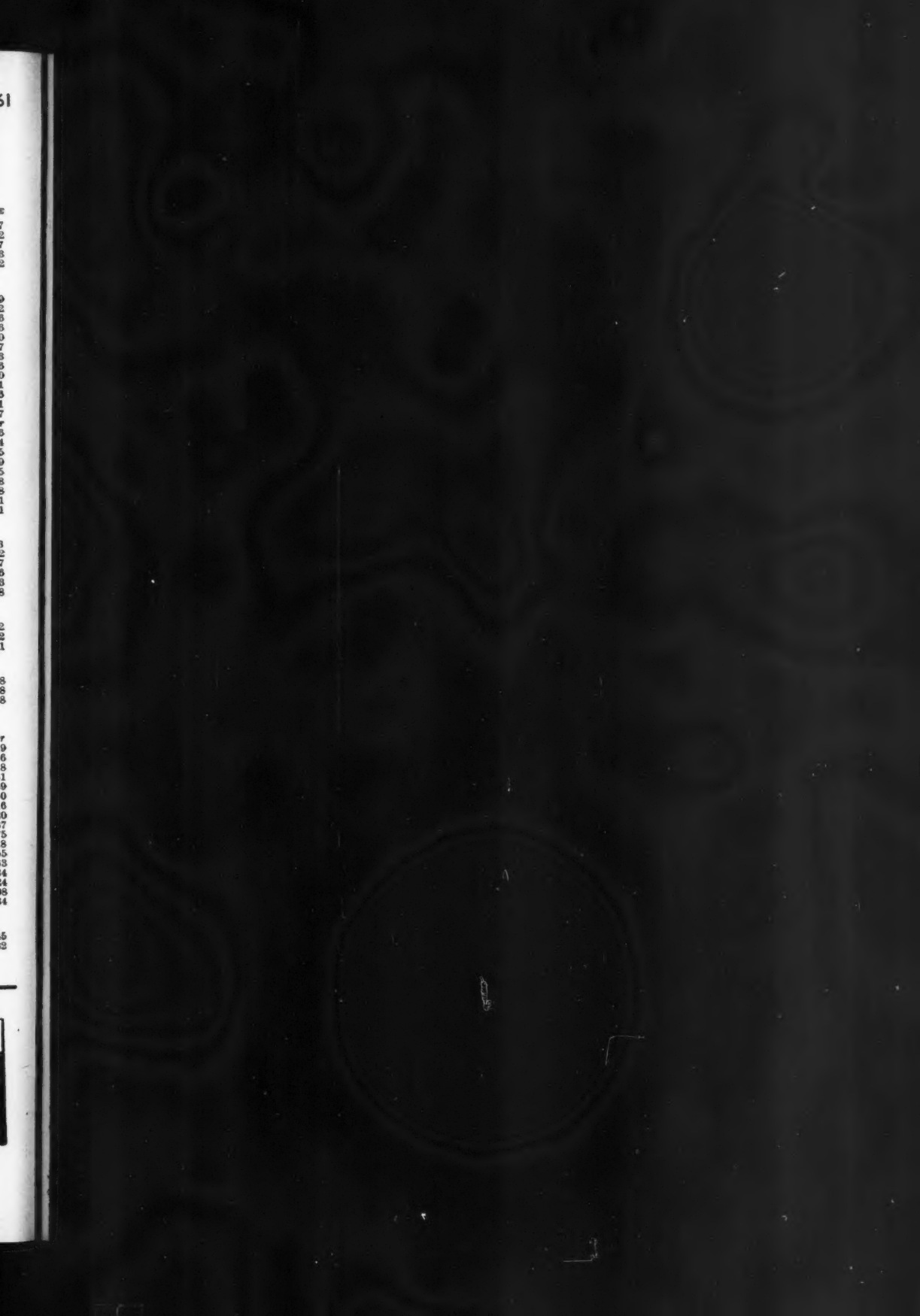

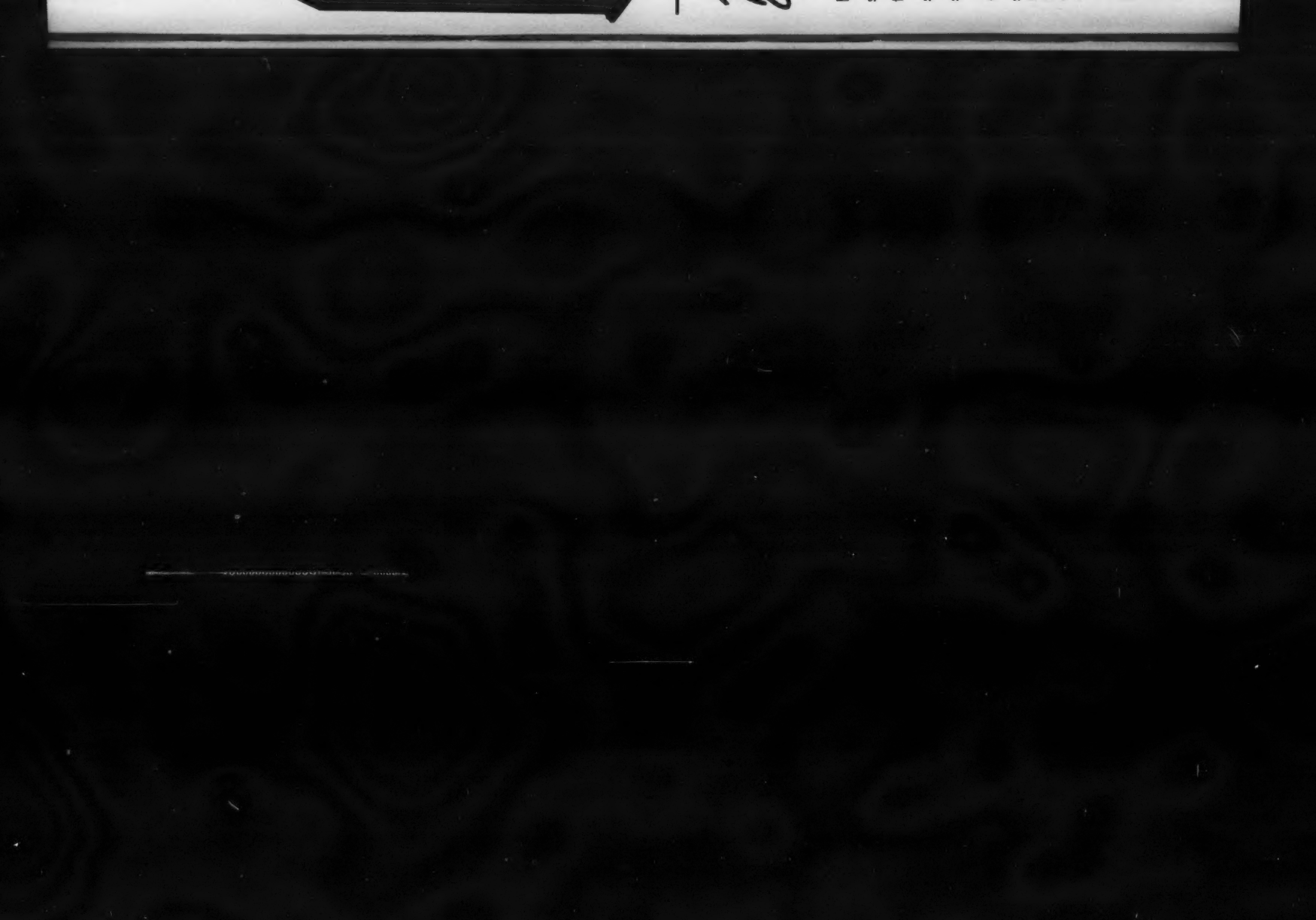

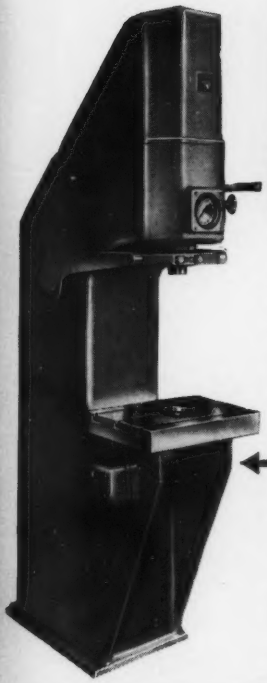

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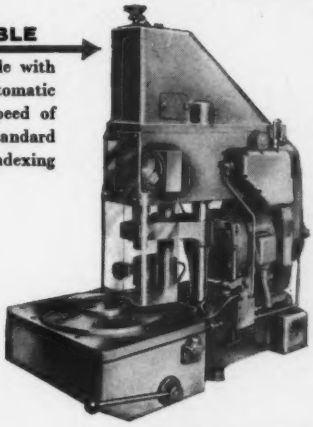

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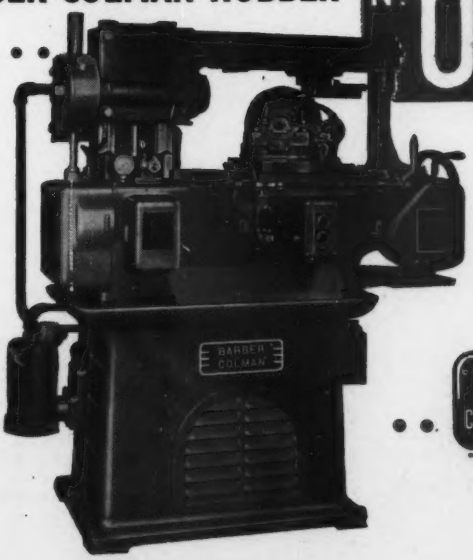

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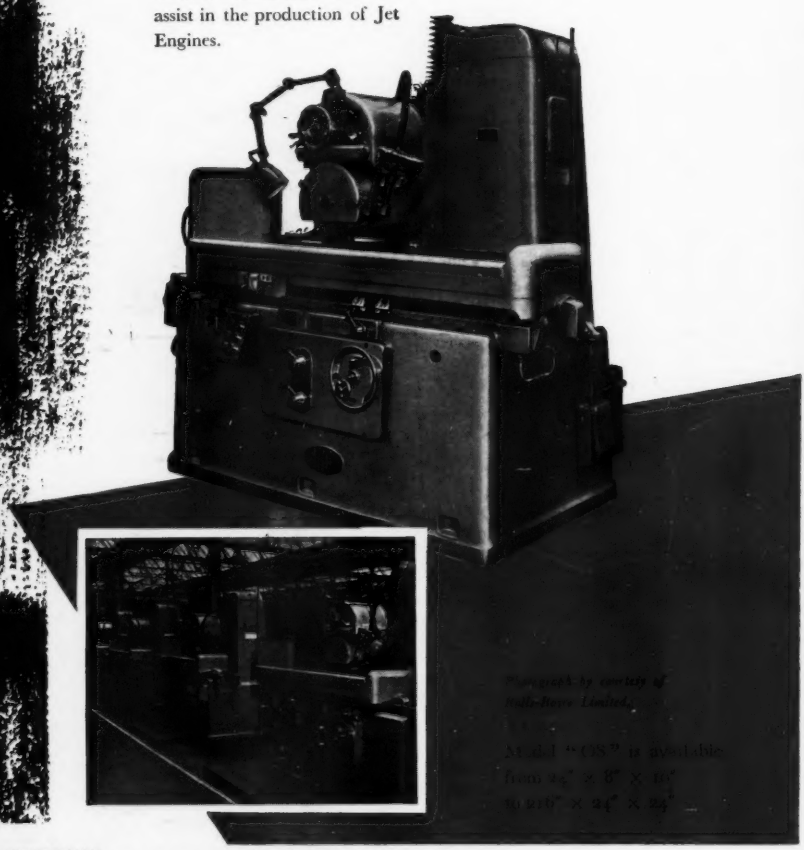

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